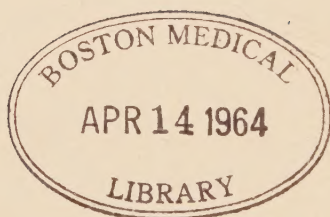


COUNTWAY LIBRARY



HC 2QXS W



t. 3800

Francis Grimes

PROCTOLOGY



Digitized by the Internet Archive
in 2025

<https://archive.org/details/proctology0000unse>

- PLATE I.—Proctoscopic Views of PATHOLOGIC RECTOSIGMOIDAL MUCOSA.
- Fig. 1. Atrophic catarrh. Mucosa thinned and dry, speckled with particles of inspissated feces.
- Fig. 2. Hypertrophic catarrh. Mucosa succulent and pale. Masses of excess mucus.
- Fig. 3. Chronic ulcerative colitis. Acute stage. Follicles swollen.
- Fig. 4. Chronic ulcerative colitis. Chronic stage. Many superficial ulcers and large areas of granulation.
- Fig. 5. Amoebic dysentery. Below on middle Houston valve, necrotic, pre-ulcerative stage. Above on upper Houston valve, later stage of ulceration.
- Fig. 6. Tuberculous ulcers of rectal mucosa. Gray base, undermined margin.

PROCTOLOGY

A TREATISE ON THE
MALFORMATIONS, INJURIES AND DISEASES
OF THE RECTUM, ANUS AND PELVIC COLON

BY

FRANK C. YEOMANS, A.B., M.D., F.A.C.S.

PROFESSOR OF PROCTOLOGY, NEW YORK POLYCLINIC MEDICAL SCHOOL; FELLOW AND
PAST PRESIDENT, AMERICAN PROCTOLOGIC SOCIETY; ATTENDING SURGEON,
NEW YORK POLYCLINIC HOSPITAL, AND NEW YORK CITY CANCER INSTITUTE;
PROCTOLOGIST, THE NEW YORK HOSPITAL



With 417 Illustrations and 4 Colored Plates

D. APPLETON AND COMPANY
NEW YORK LONDON

1929

COPYRIGHT, 1929, BY
D. APPLETON AND COMPANY

PRINTED IN THE UNITED STATES OF AMERICA

“HOMINES DEOS ACCEDUNT HOMINIBUS DANDO SALUTEM”

PREFACE

Constantly increasing knowledge of the affections of the colon, rectum and anus during recent years has developed the subject to the point where it has become a duly recognized field as evidenced by the establishment of a Section on Gastro-enterology and Proctology of the American Medical Association.

This recognition is but the reflection of the interest shown by students and practitioners who have frequently expressed a desire for a single volume adequately covering the subject without being encyclopedic on the one hand or a mere compendium on the other. It has been the aim of the author to supply this need, drawing largely from an experience of twenty-six years in clinical and private practice in this field.

Theoretical discussion has been largely sacrificed to the main purpose of producing a practical work. To this end illustrations are used freely. Many of them are original, some in colors.

Obviously, it is impossible to discuss certain affections of the terminal bowel apart from the proximal colon—notably inflammatory and infectious diseases. Approved methods of treatment have been emphasized, while obsolete procedures have been excluded so far as possible. Each subject is considered systematically—etiology, pathology, symptoms, diagnosis, complications, prognosis and treatment, especially the postoperative treatment which is so essential to success in proctologic surgery.

Successful practice requires that the physician be conversant with various methods of treatment. The comparative merits of therapeutic methods are shown, when possible, by statistics, conclusions being drawn from the results of treatment of large series of cases rather than individual cases, although pertinent examples are cited for illustrative purposes.

The technic of local and regional anesthesia is given in detail and the anesthetic of choice in rectocolonic operations is discussed. In the chapter on hemorrhoids, the injection method of treatment is covered fully. There is presented a new method of treating pruritus ani. The various types of rectocolonic ulceration are differentiated. The results of various methods of treatment of amebic dysentery are discussed at length. Modern conceptions of the etiology of the so-called non-specific chronic ulcerative colitis are analyzed, as are the results obtained by various therapeutic measures. Diverticulitis has received the attention that its importance deserves. Non-malignant tumors are considered especially in their relation to malignancy. Malignant tumors form a major section of this volume.

The importance and the methods of making an early and precise diagnosis

of malignancy are stressed. The results of operative treatment of carcinoma of the rectum by various surgeons are charted. The newer methods of treatment by Roentgen rays, radium, chemotherapy and electrothermy have received merited attention. A new electric snare for use through the proctoscope is presented.

For the privilege of using their illustrations, I am grateful to Doctors C. N. Dowd, Gaston Labat, E. S. L'Esperance, L. Carp, F. W. Rankin, R. C. Coffey, U. Maes, and J. D. Rives, G. G. Ward, R. W. Bolling, and their publishers; also The F. A. Davis Company of Philadelphia.

To the Director and the Staff of the New York City Cancer Institute, and especially to the members of my Staff at the New York Polyclinic Medical School and Hospital, I express sincere appreciation for their generous coöperation.

Sincere thanks are due my publishers for their hearty coöperation and the privilege of drawing freely from the standard Treatise of the late Doctor James P. Tuttle, with whom it was my privilege to be associated for many years.

My sincere thanks go to my artist, Mr. Alfred Feinberg, for his beautiful and excellent drawings.

If the book accomplishes its mission of alleviating suffering through the dissemination of knowledge, the author will feel amply rewarded for his efforts.

FRANK C. YEOMANS

New York City

CONTENTS

CHAPTER	PAGE
I. ANATOMY AND PHYSIOLOGY OF RECTUM, ANAL CANAL AND DISTAL COLON	I
Rectum	I
Fixation	2
Retrorectal and Superior Pelvirectal Spaces	5
Prerectal Space	5
Relations of the Rectum	6
Structure of the Rectum	7
Anal Canal	12
Conformation	12
Relations	12
Ischiorectal Fossæ	13
Muscles	14
Anal Valves or Crypts of Morgagni	16
Anal Papillæ	16
Anal Mucosa	16
Vascular Supply of the Rectum and Anal Canal	17
Arteries of Rectum and Anus	17
Veins of the Rectum	18
Lymphatics	21
Nerves	23
Distal Colon	25
Divisions	25
Structure	27
Blood Supply	29
Lymphatics	31
Nerves	31
Physiology	31
II. EMBRYOLOGY AND DEVELOPMENTAL DEFECTS OF RECTUM AND ANUS	33
Embryology	33
Cloaca	35
External Genitalia	36
Anal Canal	38
Developmental Defects	38
Incidence	38
Etiology	39
Imperforate Rectum	39
Diagnosis	40

Imperforate Rectum with Vaginal Outlet	41
Imperforate Rectum with Vesical Outlet	43
Imperforate Rectum with Urethral Outlet	43
Imperforate Rectum with Spinal Outlet	45
Urogenital Outlet in Rectum	45
Atresia Ani	45
Imperforate Anus with Vulval, Perianal, Scrotal, Anterior Urethral or Suburethral Outlet	48
Prognosis	50
Treatment	52
Proctoplasty	52
Colostomy	53
Imperforate Rectum with Outlet into Bladder, Urethra, Uterus or Vagina	54
Disposition of the Anal Infundibulum	54
Urogenital Outlet in Rectum (Anus and Rectum Normal)	55
Anus Totally Absent	55
Congenital Stenosis of Anal Canal	55
Occlusion of Anus	55
Imperforate Anus with Vulval, Perineal, Scrotal, Suburethral or Anterior Urethral Outlet	55
III. DIAGNOSTIC METHODS AND PREPARATION OF PATIENT FOR OPERATION	65
History	65
General Considerations	65
History Taking	65
Examination	67
Preparation of the Patient	67
Position	70
General Examination	73
Local Examination	74
Inspection and Palpation	74
Digital Examination	76
Vaginal Examination	78
Instrumental Examination	80
Roentgenologic Examination	93
Charcoal Test	94
Bougies and Rectal Tubes in Diagnoses	94
Examination under General Anesthesia	95
Laboratory Examinations	96
Urine	96
Stool	97
Pathologic Discharge	99
Preparation of Patient for Operation	100

CONTENTS

xi

CHAPTER	PAGE
IV. ANESTHESIA	102
General Anesthesia	102
Local and Regional Anesthesia	103
Sacral Anesthesia	103
Spinal Anesthesia	113
V. CHRONIC CONSTIPATION AND FECAL IMPACTION	117
Chronic Constipation	117
Mechanical Factors	118
Functional Motor Disturbances	118
Symptoms	122
Complications	123
Stasis Toxemia	123
Diagnosis	127
Treatment	129
Fecal Impaction	138
Symptoms	138
Diagnosis	138
Treatment	139
VI. HEMORRHOIDS	141
Definition	141
Classification	141
External Hemorrhoids	141
Thrombotic External Hemorrhoids	141
Internal Hemorrhoids	145
Occurrence	145
Etiology	146
Pathology	148
Symptoms and Signs	148
Diagnosis	151
General and Palliative Treatment	152
Injection Treatment	155
Operative Treatment	158
Electricity in the Treatment of Hemorrhoids	168
Complications	170
Postoperative Treatment	173
VII. PRURITUS ANI	176
Etiology	176
Occurrence	176
Pathology and Distribution	178
Symptoms	179
Diagnosis	179
Prognosis	180
Treatment	180

CHAPTER	PAGE
VIII. COCCYODYNIA, NEURALGIA AND HYSTERIA OF THE RECTUM .	189
Coccygodynia	189
Anatomy	190
Symptoms	190
Diagnosis	190
Prognosis	191
Treatment	191
Rectal Neuralgia and Hysteria	194
Reflex Causes	194
Spinal Cord Disease	194
True Rectal Neurosis	194
IX. FISSURE OF THE ANUS (PAINFUL OR IRRITABLE ULCER) . . .	196
Etiology	196
Location	196
Pathology	197
Complications	199
Diagnosis	199
Treatment	200
X. ABSCESS: PERIANAL, PERIRECTAL AND PELVIRECTAL	208
Etiology	208
Pathology	209
Treatment	210
Classification	210
Infralevator Abscesses	211
Cutaneous	211
Marginal Abscess	211
Ischiorectal Abscess	213
Supralevator Abscesses	216
Superior Pelvirectal Abscess	216
Retrorectal Abscess	218
Mural or Submucous Abscess	220
XI. FISTULÆ	221
Simple Fistulæ and Tuberculous Fistulæ	221
Etiology	221
Pathology	221
Symptoms	224
Diagnosis	224
Prognosis	228
Treatment	228
Complicated Fistulæ	245
Originating in Bone Disease	245
Symptoms	245
Diagnosis	245
Treatment	245

CONTENTS

xiii

CHAPTER

PAGE

Connected with Other Organs	246
Urinary Fistulæ	246
Recto-urethral Fistula	246
Rectovesical and Enterovesical Fistulæ	248
Genital Fistulæ	252
Rectovaginal Fistula	252
Rectovulval Fistula	254
Complications in Fistula Operations	254
Hemorrhage	254
Retention of Urine	254
Prolapse of Hemorrhoids and Mucosa	255
Incontinence of Feces	255
XII. CRYPTITIS AND PAPILLITIS	257
Cryptitis	257
Symptoms	257
Diagnosis	257
Treatment	257
Papillitis	258
Symptoms	258
Diagnosis	259
Treatment	259
XIII. PROCTITIS AND COLOPROCTITIS	260
Classification	260
Acute Catarrhal Proctitis	260
Etiology	260
Pathology	262
Symptoms	262
Diagnosis	263
Treatment	263
Chronic Proctocolitis	264
Etiology	265
Hypertrophic Coloproctitis	265
Chronic Atrophic Proctocolitis	267
Hemorrhagic coloproctitis	268
Symptoms	268
Diagnosis	268
Treatment	269
Chronic Mucous Colitis	270
Etiology	270
Pathology	273
Symptoms	274
Diagnosis	274
Treatment	274
XIV. CHRONIC ULCERATIVE COLITIS	276
Age	276
Sex	276

CHAPTER	PAGE
Etiology	276
Pathology	279
Symptoms	283
Course	285
Diagnosis	285
Prognosis	287
Treatment	289
 XV. DYSENTERY	 300
Bacillary Dysentery	300
Pathology	301
Treatment	302
Amebic Dysentery	302
Occurrence	302
Etiology	303
Pathology	305
Symptoms	306
Complications	307
Diagnosis	307
Prognosis	311
Treatment	311
 XVI. ULCERATION	 318
Perianal Ulceration	318
Ringworm	318
Herpetic Ulceration	318
Ulcerations of the Anus, Rectum and Sigmoid	319
Traumatic Ulceration	320
Follicular Ulceration	322
Strictureal Ulceration	322
Stercoral Ulceration	322
Varicose Ulceration	323
Hemorrhoidal Ulceration	324
Ulceration in Constitutional and Infectious Diseases	325
Symptoms	327
Diagnosis	327
 XVII. TUBERCULOSIS OF THE ANUS, RECTUM AND PELVIC COLON	 328
Perianal Tuberculosis	328
Ulcerative Perianal Tuberculosis (Tuberculosis Cutis Ani)	328
Lupoid Ulceration	330
Verrucous Tuberculosis	331
Treatment of Perianal Tuberculosis	331
Tuberculosis of the Sigmoid and Rectum	332
Tuberculous Ulceration of the Rectum and the Pelvic Colon	334
Hyperplastic Tuberculosis	337

CONTENTS

XV

CHAPTER		PAGE
XVIII.	ACTINOMYCOSIS	340
	Pathology	341
	Symptoms	342
	Diagnosis	342
	Prognosis	343
	Treatment	343
XIX.	VENEREAL DISEASES OF THE ANUS AND RECTUM	345
	Gonorrhea	345
	Etiology	345
	Symptoms	346
	Diagnosis	346
	Treatment	346
	Chancroid	347
	Treatment	348
	Chancroidal Ulceration of the Rectum	348
	Complications	348
	Phagedenic Ulceration	348
	Granuloma Inguinale	349
	Syphilis	350
	Chancre	350
	Syphilitic Ulceration of the Rectum	352
	Tertiary Lesions	352
	Congenital Syphilis	354
XX.	STRICTURE OF RECTUM AND PELVIC COLON	356
	Spasmodic or Phantom Strictures	356
	Etiology	356
	Congenital Strictures	356
	Traumatic Stricture	357
	Inflammatory Stricture	358
	Chronic Specific Infections	359
	Pathology	362
	Symptoms	363
	Diagnosis	364
	Prognosis	365
	Treatment	365
	Preventive Treatment	365
	Treatment after Development of Stricture	366
	Palliative Treatment	366
	Surgical Treatment	369
	Stricture of the Sigmoid Colon	373
	Symptoms	373
	Diagnosis	374
	Treatment	377

CHAPTER	PAGE
XXI. PROLAPSE OF RECTUM AND SIGMOID	378
Partial Prolapse of the Rectum	378
Etiology	378
Pathology	378
Symptoms	379
Diagnosis	380
Treatment	380
Complete Prolapse of the Rectum	381
Etiology	382
Pathology	382
Symptoms	386
Complications of Complete Prolapse	387
Sigmoidorectal Prolapse	387
Treatment of Complete Prolapse	389
Operative Treatment of Complete Prolapse	390
Operations through the Abdomen	405
Comment on Surgical Treatment of Complete Prolapse	411
XXII. DIVERTICULOSIS AND DIVERTICULITIS	413
Etiology	413
Pathology	415
Symptoms	417
Diagnosis	418
Prognosis	419
Treatment	419
XXIII. MEGACOLON	424
Occurrence	424
Age	424
Etiology	424
Pathology	426
Symptoms	428
Diagnosis	430
Prognosis	430
Treatment	431
XXIV. VOLVULUS OF THE SIGMOID COLON	437
Incidence	437
Pathogenesis	437
Symptoms	438
Diagnosis	438
Prognosis	438
Treatment	439
XXV. INTESTINAL OBSTRUCTION OF RECTAL AND SIGMOIDAL ORIGIN	441
Etiology	441
Symptoms	443
Diagnosis	443

CONTENTS

xvii

CHAPTER	PAGE
Prognosis	445
Treatment	445
 XXVI. NON-MALIGNANT TUMORS OF THE RECTUM AND COLON . .	 446
Adenomata	446
Symptoms	449
Diagnosis	449
Treatment	450
Papilloma	455
Symptoms	457
Treatment	459
Multiple Adenomata	459
Etiology	459
Symptoms	461
Malignant Transformation	462
Diagnosis	463
Treatment	463
Lipomata	465
Symptoms	466
Diagnosis	467
Treatment	467
Leiomyomata	468
Symptoms	469
Treatment	469
Adenomyoma of the Rectum	469
Symptoms	471
Diagnosis	471
Fibromata	472
Angiomata	473
Treatment	473
Anal Warts	475
Symptoms	476
Diagnosis	476
Treatment	476
 XXVII. SACROCCYGEAL DIMPLES, SINUSES, CYSTS AND TUMORS; I CAUDAL APPENDAGES	 479
Dimples and Sinuses	479
Diagnosis	480
Treatment	480
Cysts and Tumors	481
Dermoids	483
Teratomata	484
Sarcomata	485
Chordomata	485
Endotheliomata	485
Symptoms	485

CHAPTER	PAGE
Diagnosis	486
Treatment	487
Caudal Appendages	488
XXVIII. MALIGNANT TUMORS	490
General Considerations	490
Incidence	490
Etiology	493
Precancerous Conditions	494
Carcinoma of the Rectum and Sigmoid	496
Occurrence	496
Pathology	498
Symptoms	506
Diagnosis	510
Differential Diagnosis	513
Prognosis	516
XXIX. TREATMENT OF MALIGNANT TUMORS	520
Palliative Treatment	520
Radiotherapy of Carcinoma of the Rectum	525
Roentgen Rays	525
Radium	528
Secondary Effects of Irradiation	528
Tumor Reaction to Radiation	528
Colostomy	531
Recurrence	531
Epithelioma of the Anus	531
Electrosurgery	533
Surgical Diathermy (Endothermy)	533
Percy Cautery	537
Cancer Facts and Opinions	538
XXX. SURGICAL TREATMENT OF CARCINOMA OF THE RECTUM AND SIGMOID	540
Operability	540
Historical Considerations	542
Preparation of the Patient	544
Colostomy	544
Choice of Operation	545
Anesthesia	545
Perineal Operation (Amputation of the Rectum)	547
Position of Patient	547
Technic	547
Posterior Resection (Kraske's Operation)	556
Comment	559
Complete Posterior Excision with Colostomy	559
Technic	559
Postoperative Treatment	563

CHAPTER	PAGE
Abdominoperineal Excision (The Combined Operation)	563
Anesthesia	563
Technic	563
Postoperative Treatment	574
Excision of Carcinoma of the Sigmoid	574
Tube Resection	574
One-Stage Resection of Sigmoid for Cancer	576
Two-Stage Resection (Mikulicz Operation)	579
Causes of Operative Mortality	582
Operative and Postoperative Complications	583
Mortality	585
Recurrence	588
Function Following Operation	589
Posterior Fecal Fistula	590
Procidentia Recti	590
XXXI. SARCOMA OF THE RECTUM	591
Incidence	591
Pathology	591
Course	594
Symptoms	594
Diagnosis	595
Prognosis	595
Treatment	596
XXXII. COLOSTOMY	598
Abdominal Colostomy	599
Mortality	600
Temporary Colostomy	601
Permanent Colostomy	604
Control after Colostomy	606
Cecostomy	607
Closure of Colostomy Opening	609
XXXIII. RECTAL INCONTINENCE	613
Etiology	613
Diagnosis	615
Treatment	616
XXXIV. WOUNDS, INJURIES AND RUPTURE OF THE RECTUM AND SIG- MOID	619
Gunshot Wounds	621
Impalement	622
Rupture	622
Pneumatic Wounds	623
Symptoms	624
Treatment	625

CHAPTER	PAGE
XXXV. FOREIGN BODIES IN THE RECTUM AND SIGMOID FLEXURE . . .	628
A. Foreign Bodies Formed within the Bowel	628
B. Foreign Bodies Reaching the Bowel from Other Viscera . .	629
C. Foreign Bodies Swallowed	630
D. Foreign Bodies Introduced into the Rectum	633
Symptoms	635
Complications	636
Diagnosis	637
Prognosis	637
Treatment	638
INDEX	641

PLATES

PLATE	FACING PAGE
I. Proctoscopic views of pathologic rectosigmoidal mucosa . . . <i>frontispiece</i>	
II. Types of hemorrhoids	148
III. Malignant neoplasms	508
IV. Malignant neoplasms	594

ILLUSTRATIONS

FIGURE	PAGE
1. Anal canal, rectum and pelvic colon, interior	2
2. Cast of rectum	3
3. Cast of rectum and anal canal	3
4. Cast of rectum	3
5. Cast of rectum and anal canal	3
6. Roentgenogram of normal rectum	4
7. Showing reflection of peritoneum from rectum on to the pelvic walls	6
8. Anterior rectal space, site of deep abscess. Rectovesical (Denon-villier's) fascia, bounding the space anteriorly	7
9. Arrangement of circular muscular fibers of rectum	8
10. Diagrammatic illustration of chief aggregations of circular muscular fibers in rectal wall	8
11. Illustrating usual locations of Houston's valves	9
12. Section through a rectal (Houston) valve	10
13. Abnormal development of valves of Houston	11
14. Normal anus in repose	12
15. Levator ani muscle	13
16. Pelvic diaphragm viewed from above, fascia removed	14
17. Anatomy of the anal canal	15
18. Divisions of the pelvic outlet	16
19. Dissection of perineum showing arteries and veins	18
20. Dissection of perineum showing muscles and nerves	19
21. Internal hemorrhoidal plexus	20
22. Lymphatic distribution of perineum and vulva	21
23. Lymphatic glands of the pelvis	22
24. Sympathetic nerves of the pelvic viscera	23
25. Innervation of the rectum and anus, diagrammatic	24
26. Roentgenogram of normal rectum, sigmoid, and iliac colon	25
27. Roentgenogram of normal colon	26

28.	Line of attachment of the mesosigmoid	27
29.	Anatomical relations of rectum and sigmoid	28
30.	Arterial supply of the sigmoid colon and rectum, showing distribution of branches of inferior mesenteric artery and their anastomoses	30
31.	Successive stages in development of anus and rectum	34
32.	Successive stages in development of anus and rectum	34
33.	Successive stages in development of anus and rectum	35
34.	Successive stages in development of anus and rectum	35
35.	Successive stages in development of anus and rectum	36
36.	Successive stages in development of anus and rectum	36
37.	Development of external genitals	37
38.	Imperforate rectum, anus absent	40
39.	Fibrous cord leading from the anus to the arrested rectum	41
40.	Imperforate rectum, anal canal well formed	42
41.	Imperforate rectum, vaginal outlet	42
42.	Imperforate rectum, vesical outlet	44
43.	Imperforate rectum, posterior urethral outlet	44
44.	Imperforate anus, rectum opening into urethra	46
45.	Imperforate anal canal	47
46.	Partial occlusion of the anus	48
47.	Membranous occlusion of the anus	48
48.	Imperforate anus, opening in perineum	49
49.	Imperforate anus, opening into a cloacal chamber	50
50.	Imperforate anus, opening in prepuce	51
51.	Imperforate rectum	52
52.	Atresia ani vaginalis	56
53.	Atresia ani vaginalis	57
54.	Atresia ani vaginalis	57
55.	Left lateral (Sims' position)	68
56.	Hips elevated on pillow	68
57-A.	Lithotomy position	69
57-B.	Exaggerated lithotomy position	69
58.	Correct knee-shoulder position	70
59.	Knee-elbow position	70
60.	Incorrect position for examination	71
61.	Hanes table	72
62.	Murphy electric headlight	74
63.	Tuttle's silver probe	79
64.	Kelly's anoscope	79
65.	Bensaude's anoscope	79
66.	Kelly's sphincter dilator	80
67.	Brinkerhoff's rectal speculum with slide	80
68.	Van Buren's rectal speculum	80
69.	Beach's rectal speculum (open and closed)	81
70.	Sims' rectal speculum, fenestrated	81
71.	Kelly's proctoscope	82

FIGURE

PAGE

72. Yeomans' pneumo-electric proctoscope	82
73. Double observation window for demonstrating proctoscopic fields	83
74. Sigmoidoscopy	84
75. Sigmoidoscopy	84
76. Sigmoidoscopy	85
77. Sigmoidoscopy	86
78. Sigmoidoscopy	87
79. Sigmoidoscopy	88
80. Kelly's rectal scoop	89
81. Sigmoidoscopy	89
82. Sigmoidoscopy	90
83. Tuttle's dressing forceps	91
84. Alligator forceps for use through proctoscope	92
85. Yeomans' biopsy forceps	92
86. Wales' soft-rubber rectal bougie	94
87-A. Roentgenogram showing rubber tube, as ordinarily introduced, coiled in the rectum	95
87-B. Roentgenogram of sigmoidoscope in situ	96
88. Caudal anesthesia	104
89. Caudal anesthesia	105
90. Caudal anesthesia	106
91. Labat's regional anesthesia syringe	107
92. Labat's regional anesthesia needles	107
93. Caudal anesthesia	108
94. Caudal anesthesia	109
95. Sacral anesthesia	110
96. Transsacral block	111
97. Transsacral block	112
98. Intraspinal block	114
99. Sagittal section of the lumbar spine	115
100. Diagram in which the arrows indicate the normal fecal currents	118
101. Extreme distention of the cecum without distention of the descending colon in gradual obstruction of the lower bowel	121
102. Sigmoid with short mesentery, fixed by pelvic adhesions (diagrammatic)	123
103. Acute angulation of sigmoid, with adherent chronic appendix (diagrammatic)	123
104. Sigmoid firmly adherent to right uterine cornu and its adnexa, causing acute flexure of bowel and obstipation (diagrammatic)	124
105. Proximal and distal loops of sigmoid angulated and obstructed by adhesions of the peritoneum and the appendices epiploicæ	124
106. Importance of last sigmoid kink in connection with intestinal stasis or constipation	125
107. Gastro-enteroptosis, lateral view	126
108. Photo of woman of asthenic habitus	126
109. Adhesions causing constipation	127
110. Adhesions causing constipation	128

FIGURE	PAGE
I11. Einhorn elastic supporter	I28
I12. The Curtis abdominal support	I29
I13. The Paris belt	I30
I14. Sites of occurrence of fecal impaction	I38
I15. Kelsey's rectal scoop	I39
I16. Photomicrograph of thrombotic external hemorrhoid	I42
I17. External thrombotic hemorrhoids	I43
I18. External thrombotic hemorrhoids	I44
I19. Mixed hemorrhoid	I47
I20. Prolapsing internal hemorrhoids	I50
I21. Collapsible tube with conical tip for applying ointment to anal canal and rectum	I53
I22. Acute hemorrhoids with corona of external edema	I54
I23. Syringe and needle for injecting internal hemorrhoids	I57
I24. Infiltration anesthesia of anal canal	I59
I25. Allis intestinal forceps	I60
I26. Ligation of hemorrhoid after Allingham's method	I60
I27. Transfixion and ligature of hemorrhoid	I61
I28. Internal hemorrhoids	I62
I29. Sir C. Gordon Watson's pile clamp	I62
I30. Cooke's pile clamp	I63
I31. Mixed hemorrhoid prepared for operation	I63
I32. Clamp and cautery hemorrhoidectomy	I64
I33. Clamp and cautery hemorrhoidectomy	I64
I34. Clamp and cautery hemorrhoidectomy	I65
I35. Clamp and cautery hemorrhoidectomy	I66
I36. Exstrophy of mucous membrane following faulty Whitehead opera- tion	I67
I37. Limited excision of hemorrhoids with Earle's forceps	I68
I38. Pruritus ani	I78
I39. Pruritus ani	I87
I40. Coccygodynia	I91
I41. Coccygodynia	I92
I42. Fissure produced by rent in crypt of Morgagni	I96
I43. Site-incidence of fissure in the sexes	I97
I44. Irregular fissure or irritable ulcer of anus	I98
I45. Nerves to anus (diagrammatic)	I99
I46. Infection of triangular space through an anal fissure	200
I47. Fissure complicating hemorrhoids	201
I48. Eversion of anterior fissure by finger in the vagina	202
I49. Method of excising fissure with sentinel pile	203
I50. Incision of external sphincter muscle for the cure of fissure	204
I51. Fissure in posterior commissure	206
I52. Ischiorectal abscess in an infant thirty-two days old	208
I53. Abscess of rectum	212

154.	Correct incision for opening an ischiorectal abscess: Straight and T-incisions	213
155.	Deep ischiorectal abscess	214
156.	Deep pelvirectal abscesses	217
157.	Retrorectal abscess	218
158.	Submucous abscess communicating with ischiorectal abscess through a tract between external and internal sphincter muscles	219
159.	Fistula	222
160.	<i>A</i> , blind internal fistula. <i>B</i> , blind external fistula	222
161.	External opening of subtegumentary fistula	223
162.	Subtegumentary fistula involving ischiorectal and retrorectal spaces	224
163.	Photomicrograph of transverse section of tract of rectal fistula excised intact	225
164.	Horseshoe fistula	226
165.	Below line(<i>A-B</i>), multiple fistulous tracts with common opening in posterior commissure of anal canal. Above line, fistula with internal opening in anal canal directly opposite external opening (Salmon's law)	226
166.	Horseshoe fistula in boy aged five months	227
167.	X-ray of horseshoe fistula in male, aged thirty-two years, injected with bismuth paste	227
168.	Multiple fistulae	228
169.	Complete fistula	229
170.	Straight tubular fistula passing directly through external sphincter	229
171.	Blind external fistula posterior to rectum injected with bismuth paste	230
172.	X-ray of tortuous fistula injected with bismuth paste	231
173.	Ligature passed through fistula and secured	232
174.	Larry's grooved director	232
175.	Murray's rectal director for blind internal fistula	233
176.	Kelsey's fistula knife with silver probe point	233
177.	Director passing through internal and external openings of fistula and leaving part of tract untouched	233
178.	Grooved director passed through fistulous tract and showing how passing a bistoury along the groove and cutting outward will divide the sphincter obliquely	234
179.	Fistula laid open outside of sphincter so that the latter can be cut squarely across	234
180.	(1) Oblique incision of sphincter which is frequently followed by incontinence. (2) Transverse incision not likely to result in same	235
181.	On the left is shown the separation and lengthening of the muscle (1 to 2) due to oblique incision. On the right is seen the vicious union of the fibers and the line of incision for repairing the muscle	235
182.	First step in excision of fistula	236
183.	Removal of a fistula threaded upon a probe	236
184.	Excision of fistula and immediate suture	237
185.	Watering-pot fistula, with single internal opening	238
186.	Same case four months later	239

FIGURE	PAGE
187. Unhealed fistula with prolapse due to division of sphincter at two points	240
188. Photomicrograph of section of tract of a tuberculous fistula . .	243
189. Recto-urethral fistula	247
190. Sigmoidovesical fistula due to diverticulitis	249
191. Closure of rectovaginal fistula, showing mucous flap brought outside of rectum and sutured to the skin	253
192. Cryptitis	258
193. Diphtheritic colitis	261
194. Mallory colonigator	264
195. Jelks' recurrent rectal tube, soft rubber	264
196. Hypertrophic catarrhal proctitis	265
197. Atrophic catarrhal proctitis	267
198. Mucous colitis	271
199. Mucous colitis associated with non-rotation of colon	272
200. Mucous cast of the bowel measuring about 35 inches	274
201. Gross appearance of mucous membrane in follicular colitis . . .	278
202. Radiogram showing non-haustration and contraction of entire colon involved in chronic ulcerative colitis	279
203. External surface of resected colon	280
204. Proximal portion of colon	281
205. Portion of Fig. 204 enlarged	282
206. Photomicrograph of section of colon wall	283
207. Photomicrograph of section of colon wall	284
208. Cameron magnifier attached to Yeomans' proctoscope for close inspection of mucosa	285
209. Radiogram showing mottling of ascending colon, descending colon and sigmoid	286
210. Chronic ulcerative colitis	287
211. Chronic ulcerative colitis	288
212. Arterial blood supply of appendix	293
213. Chronic ulcerative colitis	294
214. Appendicostomy	295
215. Appendicostomy	295
216. First tier of sutures in valvular colostomy	296
217. Last tier of sutures in Gibson's method	297
218. Cecostomy	298
219. Parasitic amebæ	304
220. <i>Entamoeba histolytica</i>	308
221. <i>Entamoeba histolytica</i>	310
222. Tuberculosis cutis ani	329
223. Tuberculosis cutis ani	330
224. Typical tuberculous ulcers of intestine	333
225. Intestine in general miliary tuberculosis	335
226. Actinomycosis	340
227. Actinomycosis of ovary	342
228. Actinomycosis of rectum and pelvis	343

FIGURE

PAGE

228-A.	Granuloma inguinale	350
229.	Primary chancre of anus	351
230.	Anorectal syphiloma	354
231.	Rectum almost obliterated by syphilitic stricture, retains no barium .	360
232.	Inflammatory stricture of rectum, 4 inches in length, treated by dilatation	361
233.	Bougie arrested in sulcus surrounding a stricture	363
234.	Bougie inserted through long, inflammatory rectal stricture . . .	364
235.	Kelsey's proctotomy knife	370
236.	Stricture of rectum, perineal excision	371
237.	Inflammatory stricture of rectum and sigmoid	374
238.	Inflammatory stricture of sigmoid	375
239.	Annular stricture of lower sigmoid	376
240.	Partial prolapse of rectum	379
241.	Complete procidentia recti—First degree	381
242.	Complete procidentia recti—Second degree	382
243.	Complete prolapse of rectum	383
244.	Complete prolapse of rectum, six years' duration	383
245.	Enterocoele and rectocoele	384
246.	Enterocoele	385
247.	Rectal hernia or archocele	386
248.	Prolapse or invagination of sigmoid into the rectum, so-called' third degree prolapse of rectum	388
249.	Rectopexy for procidentia recti: The incision	391
250.	Rectopexy: The gut inverted and brought through the incision; the sutures passed through its muscular walls	392
251.	Rectopexy: The sutures out through the tissues on each side of the sacrum	393
252.	Rectopexy: The operation completed	394
253.	Sponge in rectum outlines rectocoele	395
254.	Superficial and fused fascial structures cut through and levator muscle and rectum separated in each sulcus by blunt dissection with gauze-covered finger. Anterior fibers of levator freely exposed .	396
255.	Rectum separated from vaginal wall well above area outlined for removal	397
256.	Rectopexy	398
257.	Cut edges of vagina sutured, care being taken to include the two fascial stumps in the upper sutures to insure closure of space between them	399
258.	Anterior margins of levatores grasped with sponge forceps and drawn toward midline	400
259.	A. Levatores sutured together with interrupted catgut sutures. Sharp edge of Colles' fascia seen on each side of wound next sutured with continuous suture, which at its origin is passed wide and deep to include fused fascial structures at this point. Suture also catches united levatores.	

<i>B. Skin margin then closed with a subcuticular tanned catgut suture and end tied to fascial stitch. The knot disappears between margins of the incision</i>		401
260. Enterocoele		402
261. Enterocoele		403
262. Enterocoele		404
263. Enterocoele with uterus retained		405
264. Complete prolapse of the rectum		406
265. Sigmoidopexy for prolapse of rectum		409
266. Sigmoidopexy		410
267. Diverticulosis of colon		414
268. Diverticulosis of colon		414
269. Diverticulosis of sigmoid and colon		415
270. Multiple diverticula of iliac colon (diverticulosis)		416
271. Chronic diverticulitis of sigmoid with obstruction, relieved by colostomy		417
272. Chronic diverticulitis		419
273. Carcinoma of the colon developing in the presence of diverticula		420
274. Section through wall of hypertrophied colon		428
275. Hirschsprung's disease		429
276. Megacolon		432
277. Megacolon		433
278. Volvulus of sigmoid		439
279. Transverse plication to shorten the elongated mesosigmoid by Lembert sutures passed through its outer peritoneal leaf only		440
280. Radiogram		444
281. Polyp protruded from rectum		447
282. Lymphadenoma		448
283. Solitary adenomatous polyp of rectum at level of 5 inches		449
284. Multiple adenomata of rectal ampulla as seen through proctoscope		449
285. Enormous papilloma of rectum extruded through anus		450
286. Yeomans' cold wire snare		451
287. Yeomans' polypus holding forceps		451
288. Yeomans' high frequency electric snare for use through the proctoscope		451
289. Yeomans' operating proctoscope		452
290. Handle and electrode with offset allowing unobstructed vision while using surgical endothermy through the proctoscope		452
291. Adenocarcinoma on rectal valve as viewed through the proctoscope at a height of 5 inches		453
292. Polyp forceps (left) holding tumor in snare (right). Proctoscopic		453
293. Appearance immediately after removal of tumor		454
294. The excised growth, natural size		454
295. Photomicrograph of tumor which was probably carcinomatous degeneration of an adenoma and of relatively mild malignancy		455
296. Large papilloma of anus		456
297. Sebaceous cyst at anal verge		456

FIGURE	PAGE
298. Schematic illustration of rectal papilloma	457
299. Papilloma of rectum	457
300. Defect in rectum due to very large papilloma	458
301. Photograph of the excised growth	458
302. Multiple polyposis of colon	460
303. Multiple small sessile adenomata of rectum	461
304. Multiple polyposis of colon	463
305. Multiple polyposis of entire colon	464
306. Lipoma size of a lemon, attached to left margin of anus	466
307. Submucous lipoma of sigmoid	467
308. Adenomyoma of rectum	470
309. Adenomyoma of rectum	471
310. Photomicrograph of condyloma acuminatum	474
311. Condyloma acuminatum	475
312. Condylomata acuminata	476
313. Condylomata acuminata	476
314-A. Congenital postanal fissure	478
314-B. Congenital postanal dimple	478
315. Photomicrograph of transverse section of an excised pilonidal sinus, showing the cutaneous lining	479
316. Pilonidal cyst excised intact	480
317. Pilonidal cyst. Man, aged twenty-six	481
318. Caudal appendage. Male Filipino	487
319. Incidence of carcinoma in large bowel	498
320. Percentage incidence of carcinoma in anal canal, rectum and sigmoid flexure	498
321. Epithelioma of anus	499
322. Photomicrograph of epithelioma of anus	499
323. Medullary carcinoma	500
324. Photomicrograph of colloid carcinoma of anus and rectum	501
325. Scirrhus carcinoma of intestine	502
326. Photomicrograph of adenocarcinoma of liver metastatic from car- cinoma of rectum one year after perineal excision	505
327. Double primary carcinoma of the rectum, probably from degenerated adenomata	506
328. Epithelioma of anus and vagina	509
329. Radiogram showing defect of rectum due to a large carcinoma	511
330. Radiogram: Arrows indicate large defect due to adenocarcinoma in- volving rectosigmoidal juncture	512
331. Radiogram of carcinoma of pelvic colon	513
332. Adenocarcinoma of rectum protruded through anus	514
333. Trocar needle for implanting radon seeds. Capsules and seeds of various sizes	527
334. Forceps for handling radon seeds and inserting them into the cannula	527
335. Light area around anus is a radium burn due to overirradiation of a carcinoma of the rectum	529

FIGURE	PAGE
336. Radiogram of gold seeds of radon implanted in an epidermoid carcinoma of the anal canal	530
337. Photomicrograph of epidermoid carcinoma of arms	531
338. 1. Endothermy handle. 2. Straight endothermy lancet with reversible protective shield. 3. Curved endothermy lancet about 5 inches long. 4. Straight endothermy lancet 8½ inches long with curved point	535
339. Portable endotherm	536
340. Coagulation of blood-vessels	537
341. Kraske's method of sacral resection in extirpation of the rectum	542
342. Hochenegg's method of sacral resection in extirpation of the rectum	542
343. Bardenheuer's method of sacral resection in extirpation of the rectum	542
344. Rose's method of sacral resection in extirpation of the rectum	542
345. Von Heinecke's method of sacral resection in extirpation of the rectum	542
346. Levy's method of sacral resection in extirpation of the rectum	542
347. Rydygier's method of sacral resection in extirpation of the rectum	542
348. Hegar's method of sacral resection in extirpation of the rectum	542
349. Segment of rectum removed in <i>A</i> , amputation; <i>B</i> , resection; <i>C</i> , total excision	544
350. Lymphatics of rectum	545
351. Lymphatic areas removed in various types of operation for carcinoma of the rectum	546
352. Perineal proctectomy: The incision	547
353. Perineal proctectomy: Second step	548
354. Perineal proctectomy	548
355. Perineal proctectomy	549
356. Perineal proctectomy	550
357. Perineal proctectomy	551
358. Perineal proctectomy: Posterior dissection continued	552
359. Perineal proctectomy: Operation completed	553
360. Photograph of carcinoma of rectum, perineal excision	554
361. Perineal proctectomy	554
362. Sacrum removed to expose rectum and other pelvic organs	555
363. Posterior excision of rectum: The incision	556
364. Posterior excision	557
365. Posterior excision	558
366. Posterior excision	560
367. Posterior excision	561
368. Posterior excision	562
369. Specimen removed by posterior excision	562
370. Abdominoperineal excision of rectum	564
371. Abdominoperineal excision	565
372. Abdominoperineal excision	566
373. Abdominoperineal excision	568
374. Abdominoperineal excision	569
375. Abdominoperineal excision	570
376. Abdominoperineal excision	571

FIGURE

PAGE

377.	Dudley Smith's intestinal clamp	572
378.	Adenocarcinoma of rectosigmoid, removed by Coffey's method	573
379.	Resection of the sigmoid with end-to-end anastomosis	575
380.	Resection of the sigmoid with end-to-end anastomosis	576
381.	Adenocarcinoma of sigmoid	577
382.	Two-stage resection of sigmoid (Mikulicz operation)	577
383.	Two-stage resection of sigmoid (Mikulicz operation)	578
384.	Two-stage resection of sigmoid (Mikulicz operation)	579
385.	Two-stage resection of sigmoid (Mikulicz operation)	580
386.	Two-stage resection of sigmoid (Mikulicz operation)	581
387.	Two-stage resection of sigmoid (Mikulicz operation)	582
388.	Two-stage resection of sigmoid (Mikulicz operation)	583
389.	Round-cell and spindle-cell sarcoma	592
390.	Melanotic alveolar sarcoma	593
391.	Line of incision in lumbar colostomy	598
392.	Lumbar colostomy	598
393.	Lumbar colostomy completed	599
394.	Colostomy through left rectus muscle, one year after operation	600
395.	Incision in inguinal colostomy	601
396.	Inguinal colostomy	602
397.	Temporary inguinal colostomy	602
398.	Temporary inguinal colostomy	603
399.	Temporary inguinal colostomy. Incision for opening the gut	604
400.	Permanent colostomy (Tuttle's method)	605
401.	Permanent colostomy by Tuttle's method completed	606
402.	Delatour colostomy apparatus with receptacle in position	607
403.	Cross section after extraperitoneal closure of artificial anus	609
404.	Colling's long forceps for crushing colostomy spur	609
405.	Stetten colostomy spur crusher	610
406.	Extraperitoneal closure of colostomy stoma	611
407.	Patulous anus in a woman, aged twenty-six, following excision of a portion of the external sphincter muscle during hemorrhoidectomy	613
408.	Complete prolapse of the rectum in the same case as Fig. 407	614
409.	Repair of external sphincter muscle for incontinence	615
410.	Repair of external sphincter	616
411.	Repair of external sphincter for incontinence following fistulectomy	617
412.	Patulous anus due to relaxed sphincter, method of repair	618
413.	Unknown types of foreign bodies causing intestinal obstruction	630
414.	Radiogram of pin in intestine of eleven-year-old girl, the head of which perforated the sigmoid six days after it was accidentally swallowed	631
415.	Pin shown in Fig. 414 recovered at operation	632
416.	Reaction of intestinal mucosa to foreign body stimulus	633
417.	Radiogram of open bar pin in intestine of five-months-old baby, passed in three days	634

PROCTOLOGY

CHAPTER I

ANATOMY AND PHYSIOLOGY OF RECTUM, ANAL CANAL AND DISTAL COLON

RECTUM

The rectum is the dilated portion of the distal colon which communicates with the exterior through the anal canal. It begins at the level of the third sacral vertebra where it is continuous with the pelvic colon and ends where it pierces the pelvic diaphragm at a point about $1\frac{1}{2}$ inches anterior and somewhat below the tip of the coccyx. Descending in the concavity of the sacrum and coccyx it then rests for about $1\frac{1}{2}$ inches on the pelvic floor formed by the union of the two levatores ani. Opposite the prostate it bends backward at a right angle as the perineal flexure to end in the anal canal. The posterior concavity of this flexure embraces the anococcygeal body—a mass of muscular and connective tissue intervening between the anal canal and the tip of the coccyx.

As its name implies, the rectum is comparatively straight at birth but only seldom so in adults, and in certain pathologic conditions resulting in a thickening of its wall. In the normally developed adult, however, this is far from true. Viewed from the lateral aspect, the rectum presents two distinct and constant flexures, the sacral with its concavity ventral, and the perineal with its concavity dorsal. They indicate the direction to be followed in instrumental or digital examination. When viewed from the front, the rectum usually presents three lateral flexures or indentations which are emphasized by distention. Usually there are two inflections on the left side and one between them on the right. They correspond in position to the valves of Houston within the bowel to be described later. The disposition of the longitudinal muscular fibers maintains these foldings by being shorter than the other coats of the rectum and they occur chiefly in two broad bands on the anterior and posterior surface, thus permitting lateral bulging or sacculation. This arrangement greatly increases the capacity of the rectum without overdistention.

In length the rectum is 5 to 6 inches, rather shorter in females than in males; but may be much longer. The ampulla represents $3\frac{1}{2}$ to $4\frac{1}{2}$ inches of the length. Its diameter is smallest above at the pelvirectal juncture, expanding below in the ampulla and again narrowing at the perineum. Like the cecum and

the sigmoid, the rectum is capable of great distention as is evidenced in fecal impaction and by the large foreign bodies introduced. The empty tube is slightly more than 1 inch in diameter but may be 3 inches or more when distended. The circumference varies at different levels of the organ. Quénu and Hartmann split open a large number of excised recti and found the average

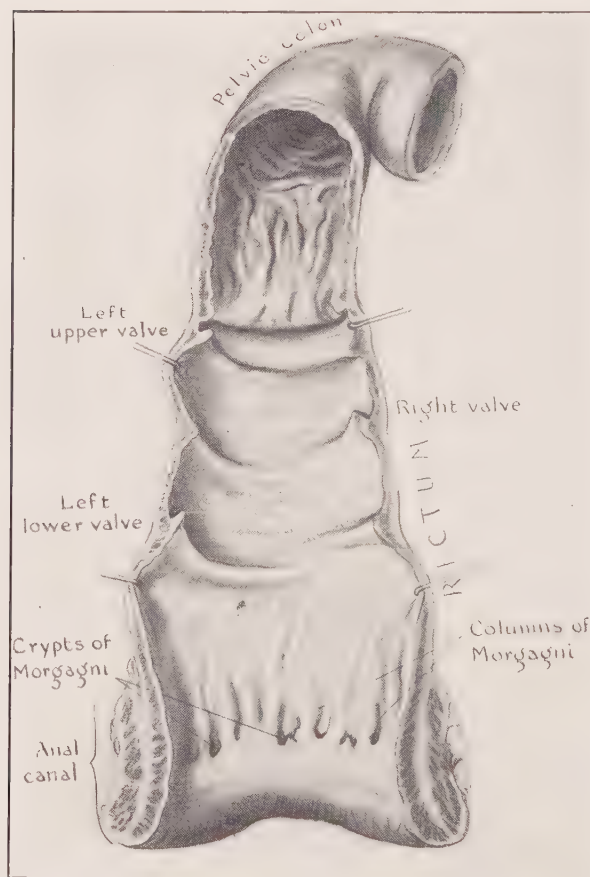


FIG. 1.—ANAL CANAL, RECTUM AND PELVIC COLON,
INTERIOR.

Note direction of mucosal rugæ.

circumference of the anus, 5 to 9 centimeters; rectal ampulla, 13 to 16 centimeters below and 8 to 10 centimeters above, at the recto-pelvic juncture. In pathologic states these figures may be greatly exceeded, Sappey reporting a case in which the viscus was 34 centimeters in circumference. In the empty state of the rectum, intra-abdominal pressure flattens the tube transversely by compressing the anterior toward the posterior wall.

Experimentally the capacity of the rectum to its superior strait was found to be from 16 to 19 ounces of water. In gradual distention the viscus may finally occupy the greater portion of the pelvic cavity. Rapid distention, as by Simon's method of introducing the whole hand for diagnostic purposes, is possible in many cases but serious injuries may result.

Fixation. — Although capable of marked variation in diameter, the rectum proper, below the third sacral vertebra, maintains its position as a fixed organ. This fixation is accomplished by the peritoneum which holds it to the posterior pelvic wall, by the blood-vessels with their fascia, and by the rectovesical folds. Its perineal portion is more firmly fixed to the structures forming the perineum, especially the levatores ani and their superior fascia, and the rectococcygeal ligament. Viewed from above, the empty rectum is comparatively straight and occupies a small part



FIG. 2.—CAST OF RECTUM.
(Quénu and Hartmann.)



FIG. 3.—CAST OF RECTUM AND ANAL
CANAL.
Showing irregular curves in former.
(Quénu and Hartmann.)

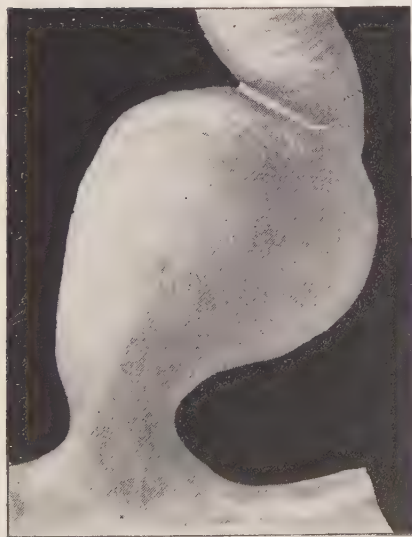


FIG. 4.—CAST OF RECTUM.
Showing sudden contraction in caliber
at juncture with sigmoid. (Quénu and
Hartmann.)



FIG. 5.—CAST OF RECTUM AND ANAL
CANAL.
(Quénu and Hartmann.)

of the posterior portion of the pelvic cavity. A large pararectal fossa is present on each side. The distended organ, however, spreads laterally beneath the peritoneum, obliterates the pararectal fossæ and fills the greater portion of the posterior part of the pelvic cavity. The anterior or ventral portion of the pelvic cavity contains the urogenital organs which an investment of pelvic fascia fixes firmly to the pelvic floor and wall.

The rectum has no mesentery and no serous coat on its posterior surface. The mesocolon ends at the pelvirectal juncture where its two serous layers separate and pass obliquely

downward, investing the sides and front of the upper two-thirds (in men, one-half) of the rectum, as a rule. Laterally the peritoneum passes to the posterior wall of the pelvis, thus forming lateral supports of the organ, and lines the pararectal fossæ. While the upper one-half or two-thirds of the rectum has a partial covering of peritoneum, in general its greater portion lies behind and beneath the peritoneum.

From the front of the rectum the peritoneum is reflected onto the bladder

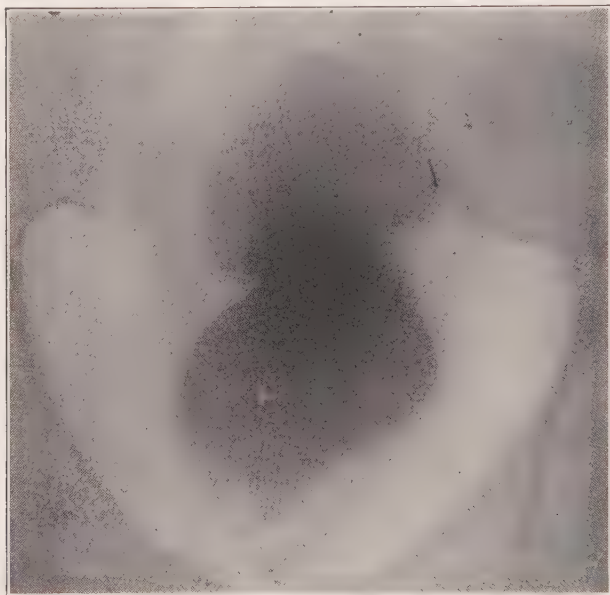


FIG. 6.—ROENTGENOGRAM OF NORMAL RECTUM (R).

in the male, forming the rectovesical pouch; in the female, onto the upper part of the posterior wall of the vagina and uterus, forming the rectovaginal pouch or culdesac of Douglas. Above, the peritoneum is closely adherent to the bowel, while below, in front and at the sides it is joined rather loosely by connective tissue.

The distance from the bottom of these pouches to the anus is of great practical importance in surgery, as the peritoneum may be accidentally opened in an operation on the anterior wall of the rectum. With bladder and rectum empty, the rectovesical pouch is about 1 inch above the base of the prostate or 3 inches above the anus. In women, the level of the sac is $\frac{1}{2}$ to 1 inch nearer the anus. The level is subject to much variation. In well-developed muscular or obese individuals it is often higher, but in the emaciated, with thin pelvic floors, it is lower than the average figures. Distention of the bladder or rectum, and intrapelvic growths, raise the level. When the perineum has been lacerated during labor and in procidentia with rectal hernia, the sac may approach very near the perineal

surface. Cases of congenital deep culdesac are occasionally encountered. In the fetus, between the bladder and the wolffian ducts, from which the seminal vesicles and ureters are derived, there is a pregenital peritoneal pouch which becomes obliterated in later development. Behind these ducts a rectogenital culdesac extends down to the membranous urethra. Normally it is obliterated only in part by fusion of its peritoneal surfaces. Failure of fusion results in the presence of a congenital deep sac in the rectovaginal septum, which may extend nearly to the perineum, the true congenital posterior vaginal hernia (E. Reis, *Am. J. Obst.*, 77, No. 5). In later development, the obliterated anterior and partly obliterated posterior culdesacs fuse into a layer of connective and elastic tissue known as the prostatoperitoneal or Denonvillier's aponeurosis.

Retrorectal and Superior Pelvirectal Spaces.—While the rectum is in close relation to other important pelvic organs, the arrangement of its fascia and surrounding cellular spaces permits of its excision without vital injury. The entire rectum below the peritoneum is surrounded by a cellulofibrous sheath, extending to the upper surface of the levator ani muscle. This sheath is elastic, thin above but thick and resistant below. It springs from the pelvic fascia and is made up of fascicles of connective tissue interspersed with fat. Anteriorly the sheath joins the prostatoperitoneal aponeurosis. Lateral prolongations surround the nervi erigentes (second, third and fourth, sacral) and the middle hemorrhoidal vessels. These united structures constitute the rectal stalks (Todd) or lateral ligaments of the pelvic rectum (Jonnesco). On each side they join the rectal ampulla at about the middle of its circumference and furnish it considerable support. In excision of the rectum these ligaments must be severed before the bowel can be mobilized. The outer layer of the rectal fascia is attached to the margins of the sacrum. Between these layers posteriorly, intervening between the rectum and the sacrum, is a considerable cellulovascular space which extends to the rectococcygeus muscle below and above becomes continuous with the prevertebral cellular layer of the abdominal cavity. A thin aponeurosis, the presacral, firmly attached to the margins of the sacral foramina, forms the posterior boundary of this area, termed the *retrorectal space*. Patel and Viannay were able to inject 200 to 300 grams of fluid into this space, but with increased tension the fluid passed out along the common or external iliac vessels. The retrorectal space contains the branches of the sacral plexus and nerves, the branches of the sympathetic nerves forming the hypogastric plexus, and the sacra media, lateral sacral, iliolumbar and middle hemorrhoidal vessels.

Prerectal Space.—This anterior cellular space above the levator ani muscles is separated from the retrorectal cavity by the lateral rectal ligaments. In men it separates the rectum from the bladder, prostate and seminal vesicles, and in women from the uterus and broad ligaments.

Denonvillier's aponeurosis or rectovesical septum, containing elastic and some unstriped muscle-fibers, divides the prerectal space transversely. This septum forms the anterior boundary of the prerectal space; is united closely to the prostate, and is attached to the sides of the rectum together with the

lateral rectal ligament. The potential space thus formed may be the site of abscesses originating in the prostate, seminal vesicles, uterus and broad ligaments. The guide to this space is the recto-urethral muscle, a thin band about 2 centimeters long and 1 centimeter wide. It arises from the anterior longitudinal layer of the rectum at the perineal flexure and passes downward and forward to fuse below the membranous urethra with the raphé of the external vesical sphincter. It pulls the anterior wall of the rectum forward. Abscesses originating in the prerectal space may penetrate the retrorectal space, but their usual

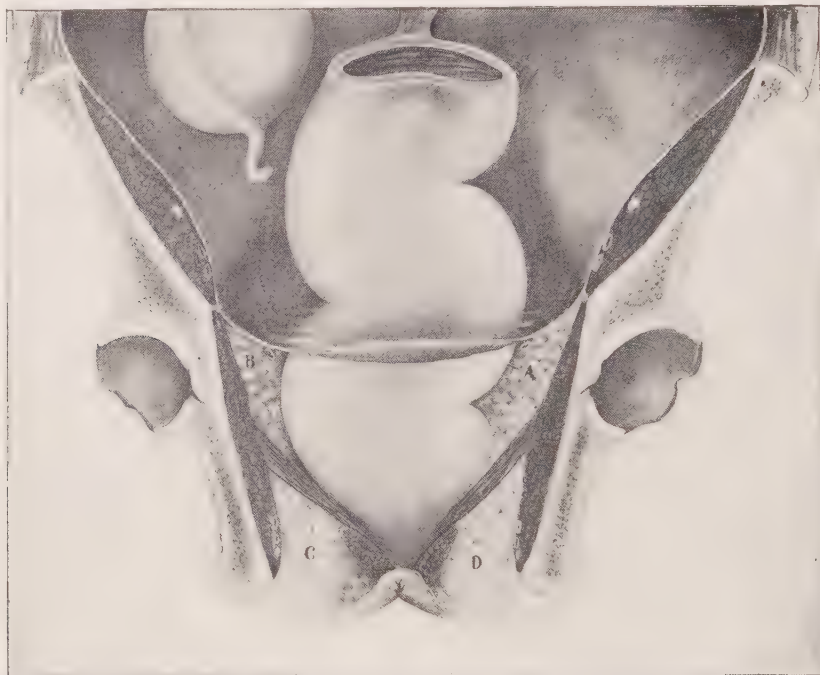


FIG. 7.—SHOWING REFLECTION OF PERITONEUM FROM RECTUM ON TO THE PELVIC WALLS.
A, B, superior pelvirectal spaces; C, D, ischioirectal fossæ.

tendency is to extend upward and forward, often pointing in the inguinal region. Retrorectal abscesses tend to perforate into the ischioirectal fossæ or burrow through the obturator foramen.

Relations of the Rectum.—These differ in the two sexes. The anterior relations are most important. In both sexes, the peritoneal culdesac in front of the rectum contains the pelvic colon or small intestine. In men, below the peritoneum, the rectum is in close relation, from above downward, with the trigone of the bladder, the prostate, seminal vesicles and the urethra. The ureters, near their ending in the bladder, cross close to the sides of the rectum at the level of the trigone. In women, in order from above downward, lie the posterior surface of the broad ligament, the neck of the uterus, cervix uteri

and posterior vaginal wall. Thus, in the male, very important structures are in intimate relation with the rectum. The probability of their early involvement, in a fixed neoplasm of the anterior rectal wall, may render the case inoperable. On the other hand, an implicated posterior vaginal wall can be easily and safely removed.

Posteriorly, above, the rectum lies in the sacrococcygeal cavity and is in relation with the structures contained in the retrorectal space already described.

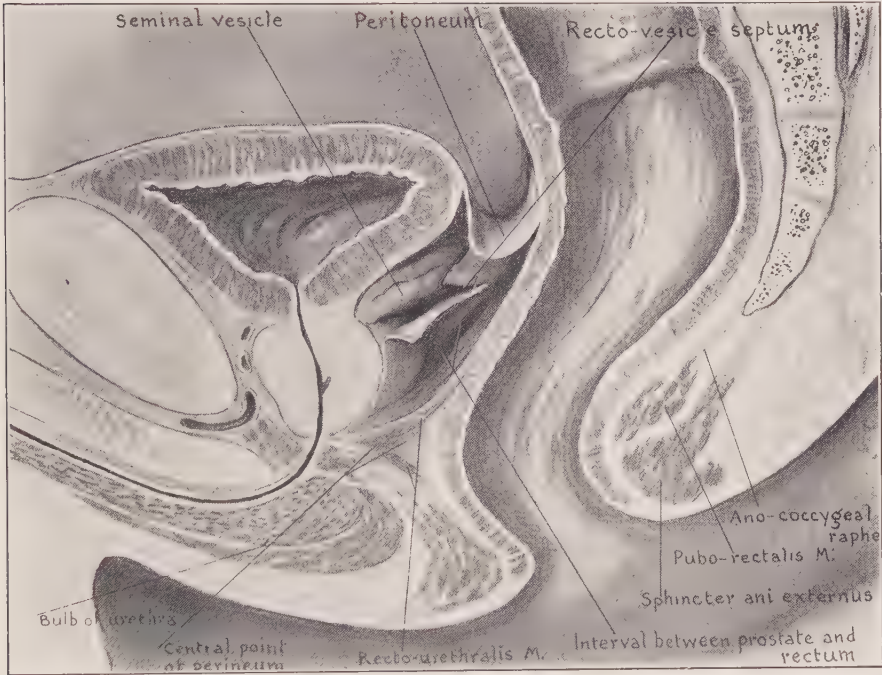


FIG. 8.—ANTERIOR RECTAL SPACE, SITE OF DEEP ABSCESS. RECTOVESICAL (DENONVILLIER'S) FASCIA, BOUNDING THE SPACE ANTERIORLY.
(After Cunningham.)

Below the coccyx it rests upon the upper surface of the levator ani muscles, where they fuse to form the posterior portion of the pelvic floor.

Laterally, above, the empty rectum is in relation with the contents of the pararectal fossæ; when distended, with pyriformis muscle and sacral vessels and nerves. Below, the levator ani muscles closely compress its lateral wall.

Structure of the Rectum.—Like the rest of the colon, the rectum is composed of four coats, from without inward—the serous or peritoneal, the muscular, the submucous and the mucous. As already described, the *serous coat* invests only partially the upper portion of the rectum, its lower segment and entire posterior surface having no peritoneal covering but a connective-tissue sheath (*fascia propria recti*) which can be dissected off in several layers.

Muscular Coat.—This is composed of an outer longitudinal layer and an inner circular layer and, as a whole, is much thicker than in the rest of the colon to perform its function of expulsion of formed feces. The longitudinal coat is a prolongation of the three *tæniæ* of the colon which spread out near the pelvirectal junction to form a complete investment. This is comparatively thin at the sides of the rectum and thicker in its anterior and posterior walls. This layer, being the shortest of the three complete rectal coats, produces the distinctive lateral indentations of its walls. Below, this layer terminates by its outer fibers uniting with the levator ani, while its inner fibers pass between



FIG. 9.—ARRANGEMENT OF CIRCULAR MUSCULAR FIBERS OF RECTUM.



FIG. 10.—DIAGRAMMATIC ILLUSTRATION OF CHIEF AGGREGATIONS OF CIRCULAR MUSCULAR FIBERS IN RECTAL WALL.

the two sphincter muscles, some fibers even passing through the internal sphincter, to join the perianal skin outside the external sphincter and termed by Ellis the *corrugator cutis ani*. The inner muscular layer forms a complete circular coat of the organ. Histologic study shows that the circular fibers are aggregated at certain levels, notably where they double inward to enter into the formation of the rectal valves, and below to form the internal sphincter.

The internal sphincter (*sphincter ani internus*) is a sudden thickening of the circular muscular fibers, beginning at the upper end of the anal canal. It surrounds the canal above to an average extent of 2 centimeters. Its lower fibers are within the grasp of the external sphincter. A cellular zone, separating the two muscles, can be felt as a shallow circular groove which constitutes a vulnerable point in the anal canal and is the site of the internal opening of

anal fistula. The internal sphincter is a wholly involuntary muscle. Some surgeons regard it as the most important agent in fecal continence, but it seems more probable that, by its size and arrangement, it exerts some passive sphincter control. Acting as a detrusor, it doubtless serves to complete the act of defecation and keep the anal canal free of contents.

Submucous Coat.—This is a network of areolar connective tissue and elastic fibers, much thicker than elsewhere in the intestinal canal, in which ramifies the hemorrhoidal venous plexus. Consequently the mucosa has a comparatively wide range of mobility over the muscularis. Physiologically it allows the mucosa to adapt itself, without injury, to the form and movement of the feces. On the other hand, it favors prolapse of the mucosa and, in certain pathologic states, the development of excessive fibrous tissue.

Mucosa.—The mucous coat or lining membrane of the rectum is thicker, more movable and more vascular, consequently redder than in the colon. The mucosa of the empty rectum presents many transverse rugæ which are obliterated by atmospheric pressure, and usually three permanent transverse folds, the rectal valves. The mucosa of the terminal pars analis recti is gathered into longitudinal ridges, five to ten in number, between the bases of which are situated the anal valves. In the pelvirectal zone the mucosa also presents a longitudinal furrowing. The mucosa is composed of a connective tissue framework, intestinal glands and an epithelial layer. The latter is a single layer of columnar cells throughout the rectum proper, but below is modified into the stratified type. The major portion of the mucosa is made up of Lieberkühn's glands. These straight tubules are set at right angles to the mucosa in the form of a honeycomb. Their lining epithelium, freely interspersed with muciparous cells, is continuous with the surface epithelium. Functionally, Lieberkühn's glands are the counterpart of the villi in absorption and they secrete mucus sufficient for lubrication. Close inspection of

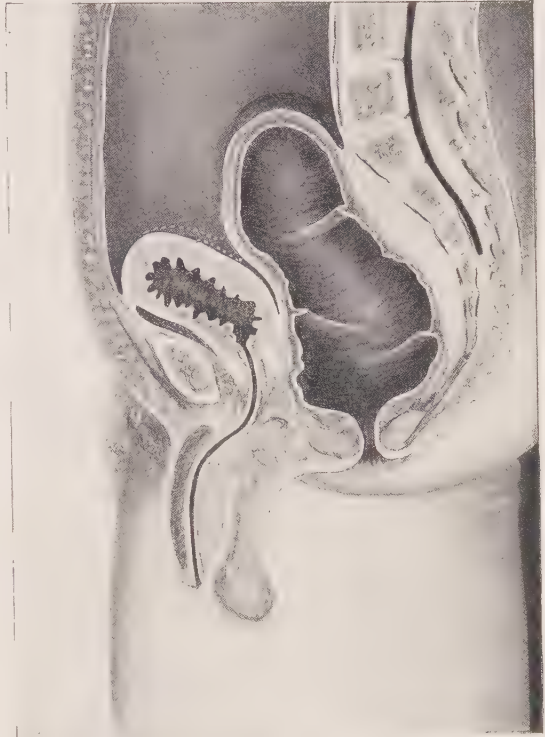


FIG. II.—ILLUSTRATING USUAL LOCATIONS OF HOUSTON'S VALVES.

White dotted line shows height to which the peritoneal culdesac is raised when bladder is distended.

the mucosa shows numerous narrow depressions, rectal pits, which mark the site of small, submerged follicles of lymph tissue.

Rectal Valves.—These were first described by Houston (*Dublin Hospital Reports*, 1830, Vol. 5). They are definite valves, present in the fetus, and not merely folds of rectal mucosa. Three is the usual number, termed superior, middle and inferior rectal valves, but there may be one more or less. They are semilunar in shape and are attached to the rectal wall transversely or somewhat



FIG. 12.—SECTION THROUGH A RECTAL (HOUSTON) VALVE.

obliquely for from one-half to two-thirds of its circumference. The usual arrangement is as follows: The middle and most constant valve arises from the right anterior quadrant of the rectal wall, about $3\frac{1}{2}$ inches above the anus. This level is not constant, for Testut, Otis and others have shown that this height varies with the reflection of the peritoneum, being just above the apex of the pouch. The superior and inferior valves are located on the left side in the posterior quadrant or more laterally. The superior valve is about 1 inch above the middle valve and the inferior valve $1\frac{1}{2}$ inches below it. The level of the upper and lower valves varies greatly. The best method of observing the valves is through a proctoscope on the living. Then atmospheric distention of the rectum makes the valves more prominent, and the appearance resembles somewhat that of a turbine wheel. The valves are usually semilunar in shape with a free, thin, crescentic margin projecting into the lumen and have a thick

base. The width of the valve, from the free margin to base, varies from 1 to 3 centimeters. The same tunics which form the rectal wall proper compose the valves. The valves consist of a fold or plication of mucosa, thicker on the upper than the lower surface; beneath this a connective tissue framework of thickened submucosa, muscular fibers from the circular coat, and rarely some longitudinal fibers. The peritoneum usually spans but indents the base of the valve. Evidently, then, the valves partially subdivide the lumen of the rectum into several chambers. In view of their structure and spiral arrangement, the valves normally impart a rotary motion to the fecal mass and prevent its too rapid passage at defecation. They are perfectly normal pliable structures which, however, may rarely become firm and obstructive as a result of pathologic changes.

Pelviorectal Valve.—Physiologically and clinically this is of more importance than the other valves just described. In the author's observations, in the majority of cases, both in the child and in the adult, the pelvic colon joins the rectum from the right. As a consequence a valvular fold of mucosa projects into the lumen of the bowel on its anterior and right aspects. In cases where the pelvic colon is directed to the left, the valve is on the ventral and left side. There is a considerable reinforcement of the non-striated circular muscular fibers in this zone and the lumen is more constricted than that of the adjacent part of the bowel. O'Beirne described this valve originally and attributed to it the function of a sphincter. Normally it serves as a retention apparatus for the contents of the sigmoid until relaxed just before the act of defecation. A knowledge of the position of this valve is essential in performing a successful sigmoidoscopy. Spastic contraction of the muscles in this area and very acute angulation are prime factors in many cases of constipation. Clinically this zone is of great significance as it is beyond the reach of digital palpation and can only be inspected through an endoscope and is involved in approximately two-thirds of the cases of carcinoma of the recto-sigmoid.

The rectal columns or columns of Morgagni are constant vertical folds of rectal mucosa, their bases reaching the mucocutaneous junction and merging above in the smooth rectal mucosa. They vary in number from five to ten and are obliterated by distention of the anal canal. They measure about $\frac{1}{2}$ inch



FIG. 13.—ABNORMAL DEVELOPMENT OF VALVES OF HOUSTON.

(Courtesy of J. R. Pennington.)

in length and $\frac{1}{4}$ inch in breadth. Each column contains an artery and a vein and usually some unstriated muscle-fibers which may resist eversion of the mucosa during defecation.

ANAL CANAL

The anal canal is the slitlike passage of communication through the pelvic diaphragm, connecting the rectum with the exterior. It begins at the level of the levator ani muscle and extends downward and backward about $1\frac{1}{2}$ inches, to open on the surface at the anus or anal orifice. In repose, the walls of the canal are maintained in lateral apposition by the levator ani muscles above,

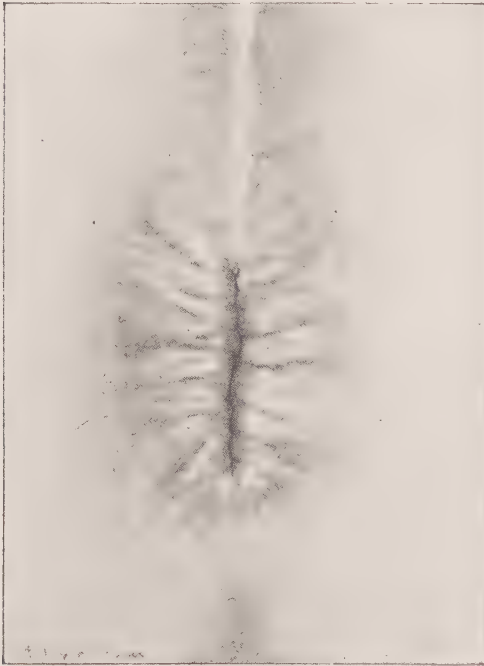


FIG. 14.—NORMAL ANUS IN REPOSE.

and the external sphincter below. Its anteroposterior diameter is $\frac{1}{2}$ to $\frac{3}{4}$ inch. The average normal anal canal will admit without injury a tube 2 centimeters in diameter. The anus at rest appears as an anteroposterior orifice in the midline of the pelvic outlet just back of a line drawn between the two ischial tuberosities, and about 1 inch in front of and below the tip of the coccyx. The perianal skin is usually pigmented, contains sebaceous and sweat glands and a growth of short hair. The corrugator cutis ani and external sphincter muscles draw the perianal skin into radiating folds, which are obliterated by distention of the anus. Extending back from the anus to the posterior surface of the coccyx, as a smooth thick band of skin, is the anal raphé, while in front of it is the perineal raphé.

Conformation. — This varies greatly. Ordinarily the anal canal is concealed and can be inspected only by retracting the nates. In some individuals, especially the obese, it may be situated at the bottom of a funnel-like approach, rendering examination difficult; while in others, the orifice appears as a slight depression on a surface which is nearly plane.

Relations.—A strong muscular wall surrounds the anal canal, from above downward, composed of the levatores ani and the internal and the external sphincters. Anteriorly, it is also in relation, in the male, with the base of the urogenital diaphragm, the bulb of the urethra, the apex of the prostate and the perineal body; in the female, with the wedge-shaped perineal body, com-

posed of muscular and fatty tissue. Laterally the sphincter muscles and anal fascia separate it from the ischiorectal fossa. Posteriorly it is in relation with the anococcygeal body, composed of muscular and connective tissue.

Ischiorectal Fossæ.—On each side of the anal canal is a pyramidal recess limited externally by the lateral wall of the bony pelvis; above and internally by the anal fascia, covering the under surface of the levator ani and the anal canal. The base of the pyramid looks backward and is covered by the skin of the nates and superficial fascia, while its apex is directed upward and forward to the junction of the anal and obturator fasciæ. The perineal fascia

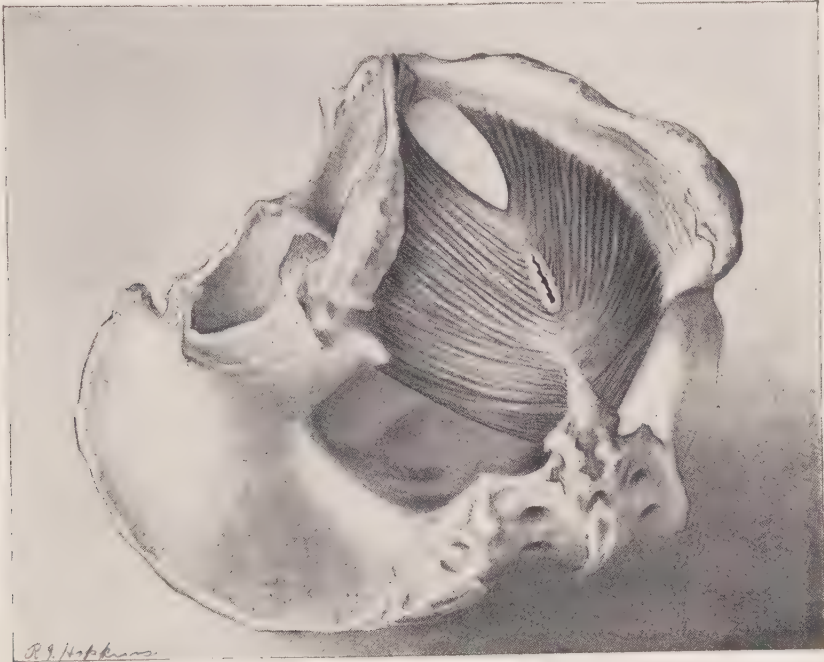


FIG. 15.—LEVATOR ANI MUSCLE.

and transverse perineal muscle bound each space in front. Forming the outer wall are the obturator fascia, obturator internus muscle, the ischium and the sacrosciatic ligaments. The gluteus maximus muscle, sacrosciatic ligament and the coccyx enclose the space posteriorly. From before backward the fossæ measure 2 to 3 inches, are 1 to 1½ inches wide at the base and about 2½ inches deep from base to apex. In women the dimensions are smaller and the spaces shallower. A fascial sheet (fascia lunata) passes from Alcock's canal medially to the wall of the anal canal, dividing the fossa into an upper and a lower compartment. Ischiorectal abscesses usually begin below the fascia lunata. The space is filled with coarse fat, separated by a strong connective-tissue network which explains the devious ramifications of abscesses in this location.

The inferior hemorrhoidal vessels traverse the posterior portion of the

space, running forward and inward to the anal region. Posteriorly, in the midline, the fossæ are almost continuous, being separated only by a narrow zone of cellular tissue between the levator ani muscles and the anococcygeal raphé. The pus of an ischiorectal abscess readily burrows through this non-resistant cellular tissue to the opposite fossa, resulting in a horseshoe fistula. As the fossa is enclosed on all sides, except at its base, with resistant fascia, ischiorectal abscesses usually "point" superficially. The elasticity of the contents of the fossæ permits dilatation of the anal canal during defecation.

Muscles.—The two extrinsic muscles requiring special consideration are the levator ani and the external sphincter. The levator muscles with their

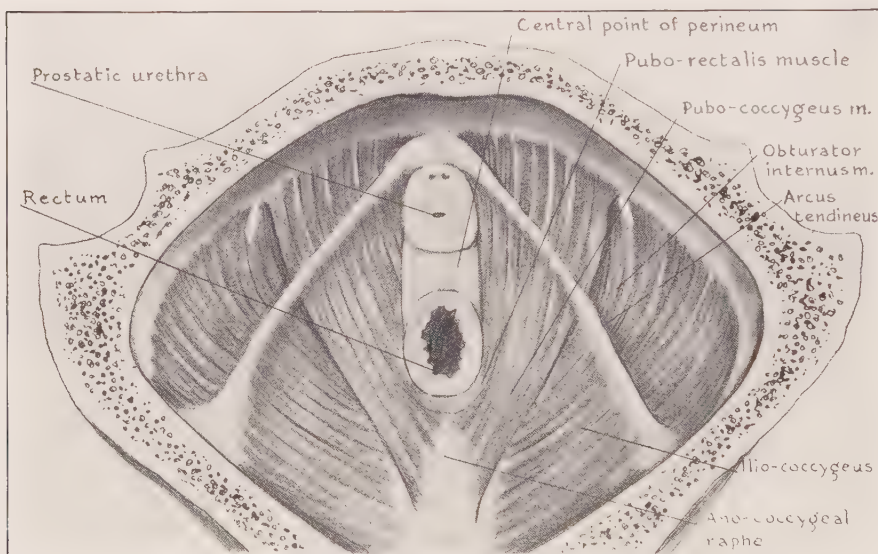


FIG. 16.—PELVIC DIAPHRAGM VIEWED FROM ABOVE, FASCIA REMOVED.
(After Cunningham.)

sheath, the rectovesical and anal fasciæ; the coccyx and its levator muscle, the coccygeus, form the pelvic diaphragm. Anteriorly a narrow space, separating the levator muscles, is occupied by the anal canal; also, in the male, by the apex of the prostate and, in the female, by the urethra and vagina. Posteriorly they meet in the dense anococcygeal raphé which extends from the upper end of the anal canal to the tip of the coccyx.

On each side of the pelvis the levator ani arises in front from the pelvic surface of the pubic bone just lateral to the symphysis, laterally from the pelvic fascia at the white line of its junction with the obturator fascia, and behind from the inner surface of the spine of the ischium. From this extensive origin the muscular fibers from each side pass backward, medially and slightly downward to join in the midline.

Anatomists assign distinct names to certain parts of the levator muscles,

from before backward: The levatores prostatae pass along the sides of the prostate to the central point of the perineum and anal canal where they blend with the deeper fibers of the external sphincter; the puborectales enclose the prostate (or vagina) and unite back of the upper portion of the anal canal, forming a sling at the anorectal juncture; the pubococcygei run backward to be inserted in the anococcygeal raphé and the sides and front of the coccyx. The latter assist in maintaining the anorectal angle, lift and constrict the terminal rectum and anal canal, thus helping to maintain its voluntary closure or aid in the completion of the process of defecation. The levator ani is innervated

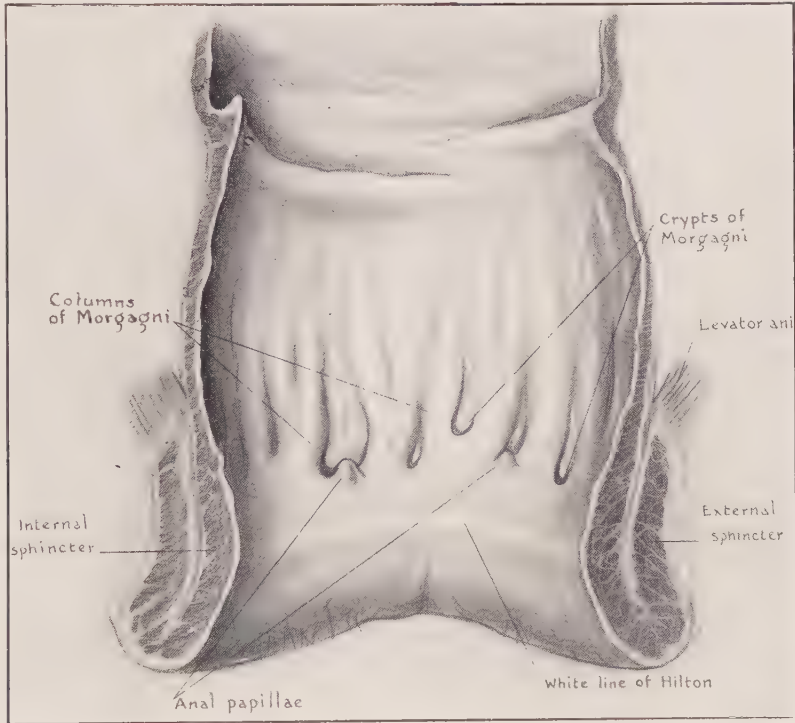


FIG. 17.—ANATOMY OF THE ANAL CANAL.

on its pelvic surface by anterior branches of the third and fourth sacral nerves, and on its under surface by the perineal branch of the internal pudic.

The external sphincter ani is a true sphincter and, in surgery of the rectum, a most important muscle. Its fibers are voluntary and complete continence of feces rests on its integrity. It arises from the dorsal surface of the tip of the coccyx and adjacent fascia, passes downward, its fibers separating to embrace the lower half of the anal canal, and, reuniting in front of it, pass forward to insertion in the perineal body. Here it is closely associated with the transverse perineal muscles and, in women, some of its fibers blend with the sphincter vaginae. The muscle is composed of a superficial and a deep layer between

which some of the fibers of the longitudinal muscular coat of the rectum pass to the perianal skin. The superficial layer is subcutaneous, and surrounds the anus in a circular manner; the fibers of the deep, thicker layer run parallel and separate to embrace the distal centimeter of the anal canal and the internal sphincter. As it is a voluntary muscle, this disposition of its fibers is a logical explanation of its purely passive closure of the anal orifice rather than its assumption of a rôle of "tonic contraction" not possessed by other voluntary muscles. Its voluntary action is to oppose or to complete the act of defecation.

Anal Valves or Crypts of Morgagni.—These are thin, semilunar folds of mucosa, projecting upward and inward, placed transversely between the bases of adjacent rectal columns. They thus form an irregular line known as the

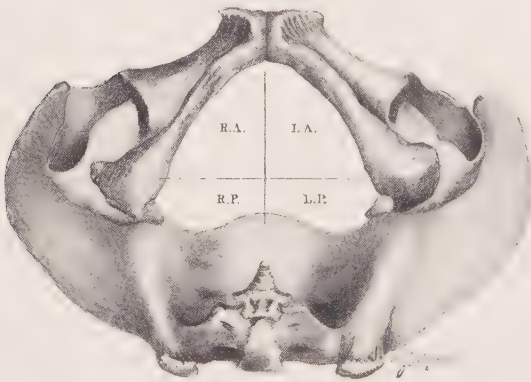


FIG. 18.—DIVISIONS OF THE PELVIC OUTLET.

R.A., right anterior quadrant; *L.A.*, left anterior quadrant; *R.P.*, right posterior quadrant; *L.P.*, left posterior quadrant; *R.A.* and *L.L.*, urogenital triangle; *R.P.* and *L.P.*, rectal triangle.

pectinate line, which marks the site of union of the proctodeum and hind-gut in the fetus, or embryologically the true anorectal line. In width the valves are 1 centimeter, or less, and average 3 to 5 millimeters in depth. Immediately above each valve is a small pocket or crypt opening upward. Usually these sinuses are shallow and of no clinical significance, but rarely are sufficiently deep to lodge foreign matter and become the starting point of a fistula.

Anal Papillæ.—Occasionally two, three or as many as six nodules, called anal papillæ,

are found on the anal valves or on the rectal columns adjacent. They consist of nerve-fibers and connective tissue and are covered with stratified epithelium. They may become hypertrophied and, because of their contained nerves (Stroud), produce a tickling sensation. Exceptionally they develop into fibrous polyplike structures.

Anal Mucosæ.—The anal canal has a mucocutaneous lining united rather intimately with the muscular layer by fibroconnective tissue which, below, merges with the superficial fascia covering the ischiorectal fossæ. The lining membrane of the anal canal is smooth and glossy, sparsely set with glands in its upper segment, has a poor blood supply but is rich in sensory nerve terminals. Its surface is covered with stratified squamous epithelium, devoid of sweat-glands and hair, but in a thicker layer than the cutaneous epithelium with which it is continuous below. Above, at the upper margin of the pectinate line it undergoes a gradual transition into the single layer of columnar epithelial cells of the rectal mucosa.

White Line of Hilton.—Just below the dentate border a shallow annular groove may be felt and sometimes seen which marks the point of division between the external and internal sphincter muscles. This line is of clinical importance as it is the most frequent site of the internal opening of fistulæ.

VASCULAR SUPPLY OF THE RECTUM AND ANAL CANAL

Arteries of Rectum and Anus.—Six arteries furnish a rich supply of arterial blood to the rectum and anus, *viz.*, the superior hemorrhoidal, two middle and two inferior hemorrhoidal, and the middle sacral. The superior hemorrhoidal artery, the terminal branch of the inferior mesenteric, descends between the two layers of the pelvic mesocolon. On reaching the beginning of the rectum in its posterior median line outside the muscular coat, it divides into two main branches which course downward and forward around the sides of the organ. The right, usually the larger branch, lies more posteriorly, and the left more anteriorly. These two branches subdivide into five to eight secondary branches which pierce the muscular coat about 4 inches above the anus and continue downward in the submucosa as parallel “terminal branches” as far as the pectinate line. Above this level they anastomose by twigs with one another and with terminal branches of the middle and, to a less extent, with the inferior hemorrhoidal arteries. The *middle hemorrhoidal* arteries, one on each side, have a variable origin. They are usually branches of the hypogastric or the internal pudic. They divide into branches, some of which supply the lower portion of the rectum and others pass through the muscular coat just above the internal sphincter to anastomose in the submucosa with each other and with branches of the superior and inferior hemorrhoidal. Their chief distribution is to the anterior aspect of the lower portion of the rectum.

The inferior hemorrhoidal arteries, usually in two or three branches on each side, are offshoots of the internal pudic just above the spine of the ischium. They cross the ischiorectal fossa in an inward and forward direction and are distributed to the levatores ani and the sphincter muscles. Other branches pierce the sphincters to supply the lower portion of the anal canal and communicate above with the anastomosing branches of the middle and superior hemorrhoidal arteries. Their main distribution to the rectum is to the posterior aspect of its lower portion.

The middle sacral artery descends from the bifurcation of the aorta on the ventral surface of the sacrum and coccyx to end in the coccygeal (Luschka's) gland. Its main distribution is to the muscularis of the lower rectum.

Comment on the Arterial Circulation of the Rectum.—Of the three hemorrhoidal arteries, only the superior is purely a rectal artery, being distributed solely to the mucosa of the entire rectum and to the muscularis of the upper portion; the middle and inferior hemorrhoidal supply the muscularis of the lower portion. Consequently the lower segment of the rectum has an adequate blood supply, even when the superior hemorrhoidal is ligated, but the upper

portion of the rectum depends on the superior hemorrhoidal for its circulation. On this account there is a liability to a sloughing of the bowel when an anastomosis is done in the upper part of the rectum. Outside the rectal wall there is, as a rule, a distinct anastomosis between the superior and middle hemorrhoidal arteries at a point varying from 2 to $3\frac{1}{2}$ inches above the anus. In thirteen subjects examined by Quénu it was absent only in one.

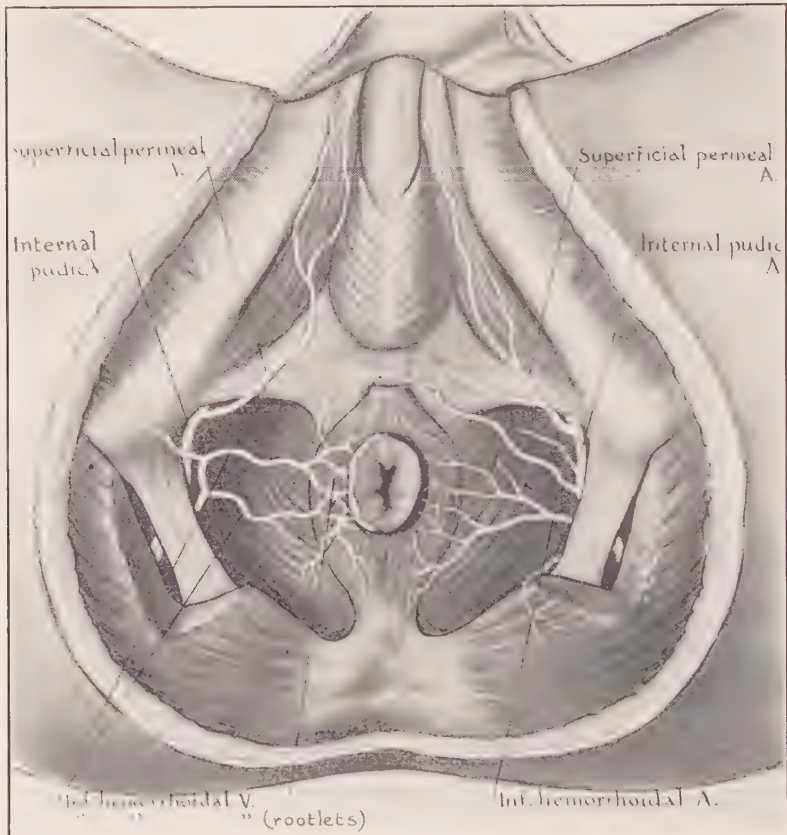


FIG. 19.—DISSECTION OF PERINEUM SHOWING ARTERIES AND VEINS.

Veins of the Rectum.—The veins of the rectum and anal canal correspond to the arteries just described in name and course. They are arranged mainly in two large plexuses which communicate freely with each other. The internal or superior hemorrhoidal plexus, situated in the submucosa, collects the blood chiefly from the mucosa of the rectum proper and, through the inferior mesenteric and splenic, transmits it to the portal. The middle and inferior hemorrhoidal veins and the middle sacral collect the blood chiefly from the muscularis of the rectum and anal canal, from the perirectal tissues, the levator ani, part of the base of the bladder, prostate, seminal vesicles and, in women, the vagina,

and empty into the general circulation through the hypogastric, tributaries of the inferior vena cava. There is a rather free anastomosis on the rectal wall between the superior and middle hemorrhoidal veins and the middle sacral, constituting the external hemorrhoidal plexus. The veins of this plexus have valves which tend to become incompetent in adults, as has been demonstrated by injecting them through the inferior mesenteric. Thus, communication, partially guarded by valves, exists between the systemic and the portal circulations.

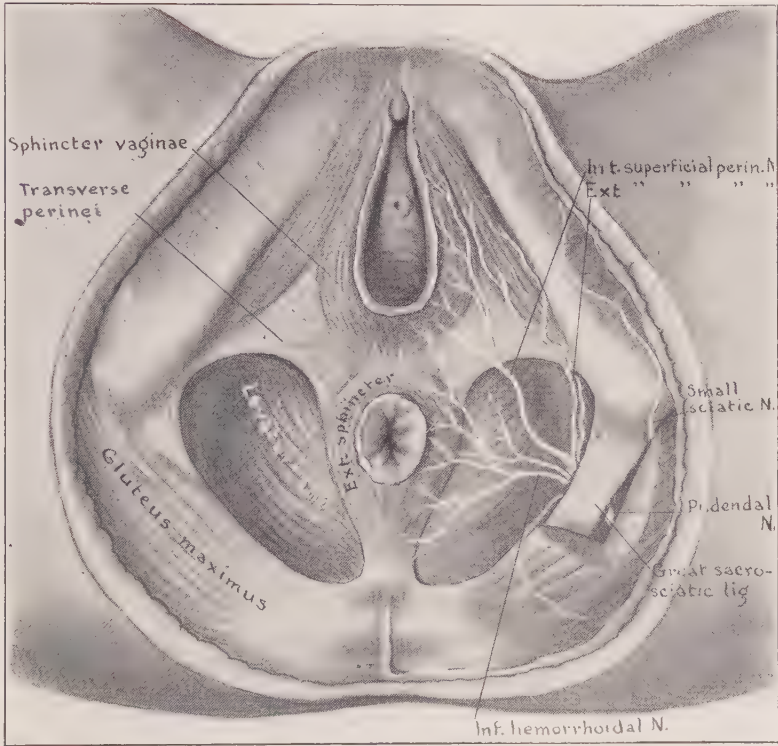


FIG. 20.—DISSECTION OF PERINEUM SHOWING MUSCLES AND NERVES.

Below the reflection of the peritoneum on the anterior wall of the rectum and between it and the prostate or vagina is a considerable venous plexus (prostatic or vaginal) chiefly radicals of the middle hemorrhoidal vein, which bleed freely when cut in performing excision of the rectum.

The internal hemorrhoidal plexus begins in numerous small lenticular venous channels, each about the size of a grain of wheat, in the submucosa just above the pectinate line where they surround the rectum at varying levels. Below, they communicate with the radicles of the external hemorrhoidal vein over the external sphincter through the small "anal" veins which can be traced beneath the mucocutaneous lining of the anal canal. This forms a second point of connection between the portal and systemic circulations. Above, one or more twigs

from each venous pool or ampullary expansion anastomose to form an intricate plexus, surrounding the rectum. Larger branches proceed upwards from this plexus till from six to ten trunks of considerable size are formed which, with their corresponding arteries, pierce the muscularis about midway of the rectum and unite on its surface to form the superior hemorrhoidal vein.

The lenticular venous channels above described are located principally in the columns of Morgagni and on engorgement project as internal hemorrhoids.

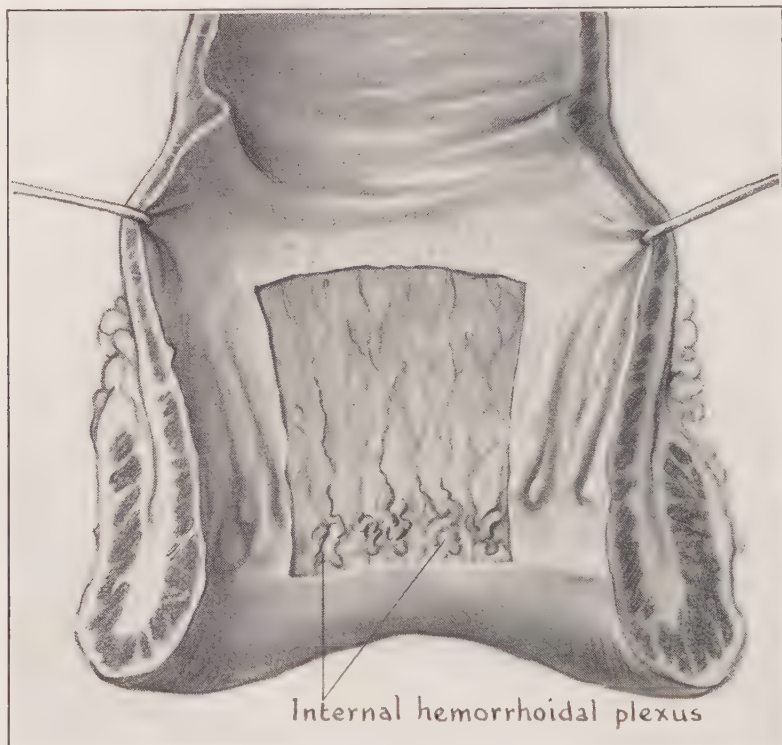


FIG. 21.—INTERNAL HEMORRHOIDAL PLEXUS.
Venous pools, and veins perforating muscularis.

It is because of this arrangement that internal piles develop in definite quadrants of the rectum. Two other anatomical facts favor the development of internal hemorrhoids, *viz.*, first, the absence of valves in the superior hemorrhoidal vein and, second, possible constriction of the veins at their points of passage through the muscularis of the rectum.

The inferior hemorrhoidal vein arises from a venous network beneath the skin on the outer surface of the external sphincter muscle and through the internal pudic drains into the general circulation. Many branches from the lower part of the internal hemorrhoidal plexus perforate the external sphincter to join this network as do the veins collecting the blood from the muscular tunic

and lower half of the membrane lining the anal canal. The clot formation in the connective tissue, resulting from the rupture of one or more of the venules of this network, constitutes the thrombotic variety of external hemorrhoids.

Lymphatics.—A knowledge of the lymphatic distribution of the rectum and anal canal is of prime importance in tracing disease processes in these organs. This knowledge has been obtained partly but imperfectly by injecting the lymphatic trunks. Clinical observation has been of the highest value in determining

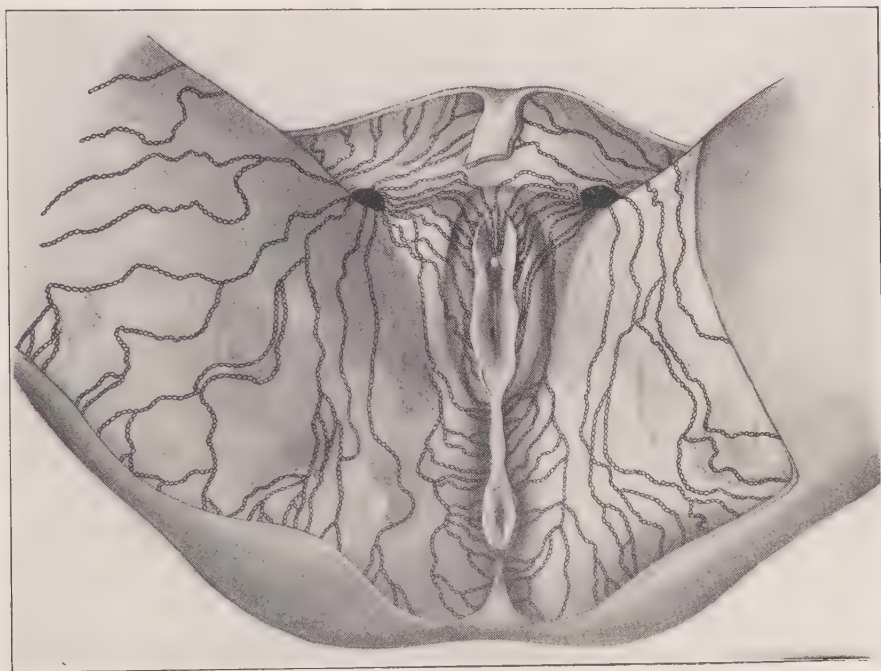


FIG. 22.—LYMPHATIC DISTRIBUTION OF PERINEUM AND VULVA.

Note direct drainage of anal and perianal lymphatics into inguinal glands. (After Toldt, *Atlas of Human Anatomy*, Rebman.)

the paths of lymphatic spread of inflammatory processes and malignant disease. However, our experience in malignant disease accords with the statement of Miles: "Cancer cells do not spread according to the anatomical lymphatic distribution but according to laws of their own." The lymphatics of the rectum and anal canal comprise intramural and extramural systems. The lymphatics of the rectum proper are a very rich network in the mucosa and the submucosa but, comparatively, they are developed sparsely in the mucosa of the anal canal. The intramural lymphatics of the rectum and anal canal are arranged in three groups, corresponding to the areas drained.

(a) *The inferior group* is a very fine network and drains the perianal skin and lining membrane of the anal canal below the white line. Three to five collecting trunks on each side pass through the perineum along the cruroscrotal

folds to join chiefly the superficial lymphatic glands below Poupart's ligament, though other trunks may connect with other groups of inguinal lymphatics.

(b) *The middle group* drains the area of the white line and the zone immediately above it, corresponding to the columns of Morgagni. The collecting trunks perforate the muscularis, some above and some below the insertion of the levatores. Of the former, some join the lymphatics of the superior group and others follow the middle hemorrhoidal vessels to finally end in the hypogastric lymphatic glands. Those below the levatores ramify a short distance in the contents

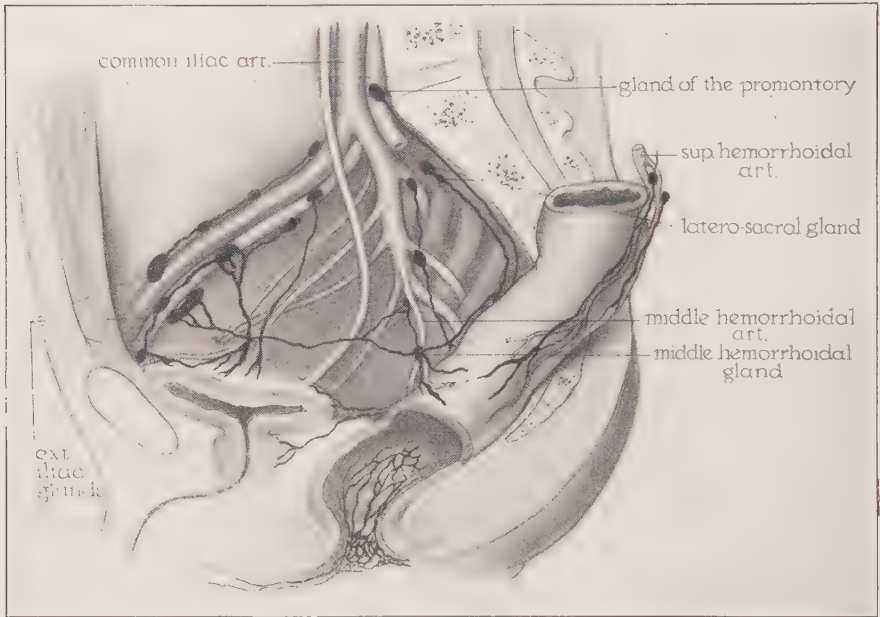


FIG. 23.—LYMPHATIC GLANDS OF THE PELVIS.
Note lymphatic drainage from anal canal through perineum.

of the ischiorectal fossa, then usually perforate the muscle and drain into the hypogastric gland. This group corresponds roughly to the middle and inferior hemorrhoidal vessels.

(c) *The superior group* corresponds to the superior hemorrhoidal vessels. They originate in the mucosa and submucosa of the entire rectum and anal canal above the area of the white line. Their collecting trunk passes through the muscularis along the sides of the vessels to the sacral lymph-nodes, four to six in number and of larger size, grouped above the origin of the superior hemorrhoidal artery in the pelvic mesocolon in front of the promontory of the sacrum. These are the true regional lymph glands of the upper lymphatic area of the rectum. In their perirectal course they lie close to the muscularis, having the fibrous sheath of the rectum externally, and drain through half a dozen smaller pararectal (Cunéo) lymph-nodes distributed in an irregular chain from just

above the levatores to the upper end of the rectum. This group is connected with the hypogastric and mesocolic lymph-nodes and to one another by the middle sacral plexus. Above, efferent trunks join the lumbar glands, while below some channels join the perianal lymphatics to drain into the inguinal glands.

Nerves.—The nerve supply of the rectum is mainly from the sympathetic system, and that of the anal canal chiefly from the cerebrospinal system.

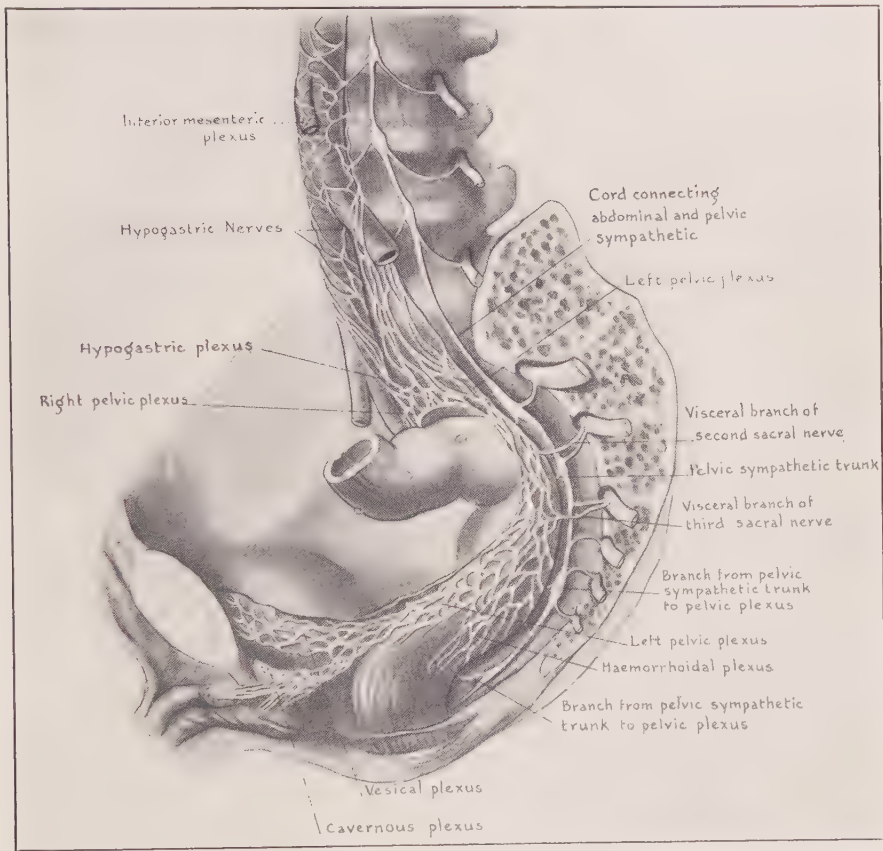


FIG. 24.—SYMPATHETIC NERVES OF THE PELVIC VISCERA.
(After Cunningham.)

The sympathetic fibers come from the inferior mesenteric plexus, through its subordinate superior hemorrhoidal plexus, which accompanies the superior hemorrhoidal vessels to the rectum, and from fibers of the two pelvic plexuses which follow the middle hemorrhoidal vessels. Further, entering into the formation of the pelvic plexuses are visceral branches of the cerebrospinal system, direct from the second, third and fourth sacral nerves, conveying motor and inhibitory impulses to the rectal musculature.

The nerve-fibers are distributed to all structures of the rectal wall, including

the internal sphincter muscle, and, as in the rest of the intestinal tract, are arranged in two networks: Auerbach's plexus between the longitudinal and circular layers of the muscularis, and Meissner's plexus within the submucosa.

The innervation of the anal canal is from the cerebrospinal system through the third and fourth sacral and internal pudic nerves. The inferior hemorrhoidal nerve, usually a branch of the pudic, accompanies the inferior hemorrhoidal vessels across the ischiorectal fossa and supplies the external sphincter muscle, the mucocutaneous lining of the anal canal and the perianal skin. The perineal skin is innervated largely by cutaneous filaments of the perineal nerve, and the

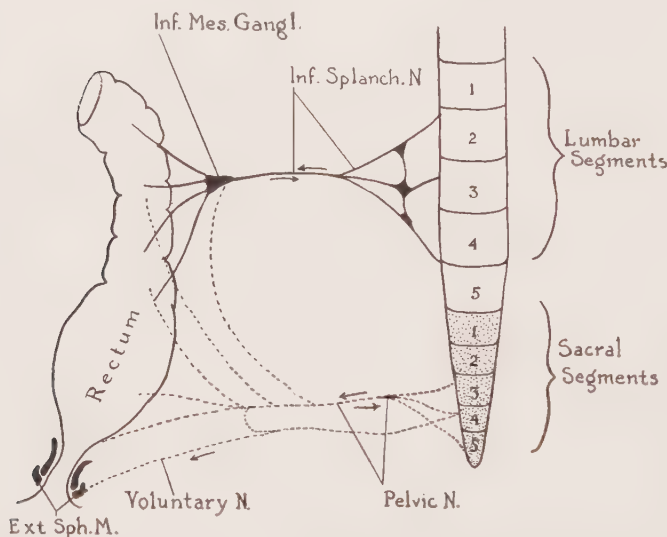


FIG. 25.—INNervation OF THE RECTUM AND ANUS, DIAGRAMMATIC.

(After H. Strauss, Berlin.)

integument over the ischiorectal fossa by offshoots from the plexus formed by the three lower sacral nerves.

The external sphincter ani receives its triple nerve supply from the third and fourth sacral nerves through the (a) inferior hemorrhoidal branch of the internal pudic, (b) the deep perineal branch of the internal pudic and (c) the perineal branch of the fourth sacral nerve. All of these branches possess both sensory

and motor fibers, and with them are distributed the sympathetic nerve filaments.

The reflex or "defecation" center is located in the spinal cord at about the level of the first lumbar vertebra. It governs the action of the rectal musculature and the sphincters and, even when separated from the brain, seems to retain unimpaired its influence in carrying on the act of defecation.

Owing to its rich supply of sensory nerve-endings, the region of the anal canal is very highly sensitive. A minute lesion here—for example, a fissure—causes exquisite pain. Painful sensations occur for about 1 inch above the pectinate line, but above this level the rectal mucosa is practically insensitive to tactile and thermal stimuli. Indeed, examinations and minor operations, on the mucosa of the rectum proper, can be carried out without annoyance to the patient, but unfortunately, for the same reason, pathologic processes may reach

an advanced stage before giving rise to any sensation of pain. An ill-defined "sensation of fullness," characteristic of many conditions occurring in the alimentary tract, is doubtless a variety of muscle sense elicited by stretching the muscular coat on dilatation of the bowel.

The so-called referred pains from this region are of diagnostic import. Their anatomic explanation rests on the fact that the nerves supplying the region of the anal canal are from the same spinal nerves as those to the genital organs, bladder and urethra. This accounts for the retention of urine frequently occurring after rectal operations, the pain from an anal lesion referred to the uterus, etc. Likewise the pain of an anal lesion may be referred through the obturator nerve to remote parts—the hip-joint and inner side of knee.

DISTAL COLON

Divisions.—The distal colon extends from the splenic flexure and comprises the descending colon, iliac colon, pelvic colon (sigmoid flexure or omega loop) rectum and anal canal.

The *descending colon* is 4 to 6 inches in length and about $1\frac{1}{2}$ inches in width, being much narrower than the ascending colon. From its beginning deep in the left hypochondrium, posterior to the stomach, it descends almost vertically to the iliac crest. Its posterior surface, usually destitute of peritoneum, rests upon the posterior abdominal wall to which it is connected by areolar tissue. Its lateral and anterior surfaces have a serous coat.

The *iliac colon* is a continuation of the descending colon and agrees with it in every respect except in position and relationship. It has no mesentery in 90 per cent of cases. It is 5 to 6 inches in length, passes downward and inward on the iliacus muscle, then crossing the psoas major muscle medially, ends at its inner border where it is continued as the pelvic colon. It crosses the left ureter, which is an important point in surgery. The *pelvic colon* begins at the brim of the pelvis at the inner point in surgery. The *pelvic colon* begins at the brim of the pelvis at the inner border of the psoas major muscle and merges into the rectum opposite the third sacral vertebra or the intervertebral disk just below it. Its course is not constant, but it commonly crosses the pelvis from left to right, bends backward and then

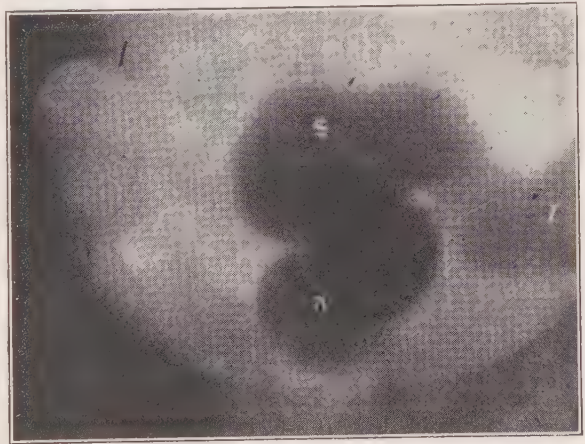


FIG. 26.—ROENTGENOGRAM OF NORMAL RECTUM, SIGMOID, AND ILIAC COLON.

returns along the posterior wall of the pelvis toward the midline and curves downward as the rectum.

Owing to the small size of the pelvic cavity, only the terminal portion of the pelvic colon lies in the pelvic cavity in children at birth. The length of the pelvic colon is stated to be 16 or 17 inches, but may be only 5 inches or unusually long, 35 inches, as the author has found by actual measurement on two hundred cadavers. Its average length in the male is greater than in the

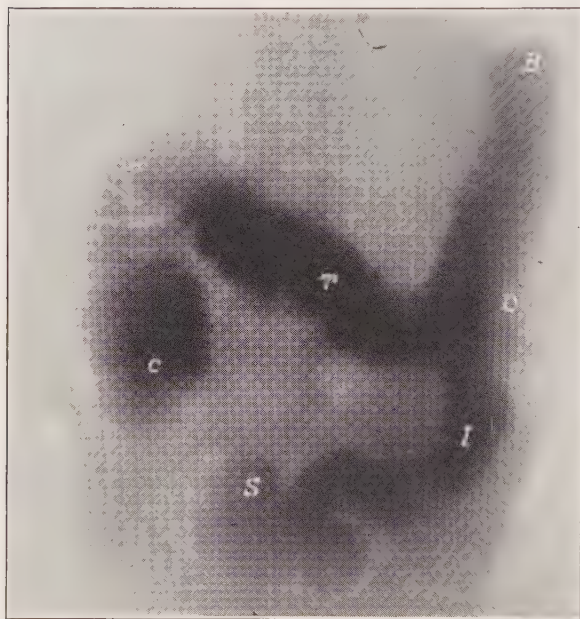


FIG. 27.—ROENTGENOGRAM OF NORMAL COLON.

C, cecum; H, hepatic flexure; T, transverse colon; B, splenic flexure; D, descending colon; I, iliac colon; S, sigmoid loop.

female. This variation in length and that of its mesentery results in corresponding variation in shape and position of the pelvic colon. When empty, it lies in the pelvic cavity in the majority of cases but when distended or encroached upon by the distended rectum, bladder or enlarged uterus it is displaced upward into the lower abdomen. In passing into the pelvis, it crosses the external iliac vessels and, in its pelvic position, rests upon the bladder or uterus, the small intestine lying above it. It usually possesses a well-developed fan-shaped mesentery attached to the dorsal wall from the left sacro-iliac synchondrosis along the brim of the true pelvis to the sacral

promontory; here it bends at an angle and descends vertically to the third sacral vertebra, where the pelvic colon becomes the rectum and the mesentery ceases. As this base of attachment is only about 10 centimeters in length, the pelvic colon with its long mesentery is anatomically predisposed to volvulus. The pelvic mesocolon is not infrequently the site of chronic inflammation with resultant narrowing of the pedicle which further tends to favor volvulus.

Intersigmoid Fossa.—When the pelvic colon is elevated, just beneath the beginning of the pelvic mesocolon on its outer side and between it and the left iliac vessels the orifice of a pocket of peritoneum is often found. This is termed the intersigmoid fossa. It may be large enough to admit the last joint of the little finger and become the sac of an internal hernia. The fossa is directed upward and the left ureter lies behind its apex. The fossa is due to imperfect

fusion in the fetus of the mesentery of the descending colon with the parietal peritoneum.

Structure.—Points of identification which distinguish the colon from the small intestine are (*a*) the *tæniæ coli*, three longitudinal, flat, muscular bands on its surface, (*b*) sacculation of its walls, and (*c*) *appendices epiploicæ*, irreg-

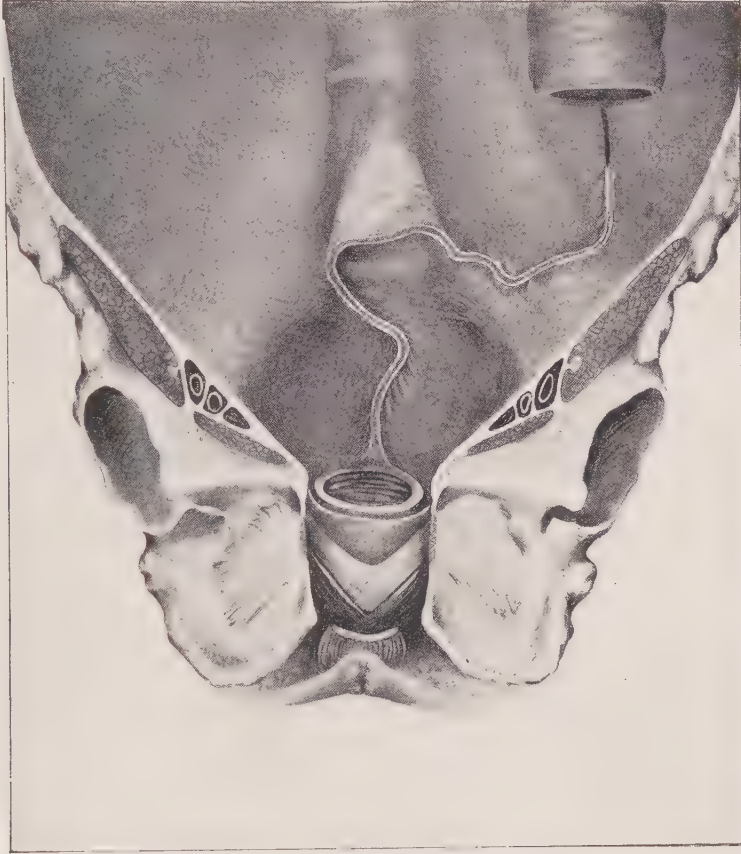


FIG. 28.—LINE OF ATTACHMENT OF THE MESOSIGMOID.

ular pouches of its peritoneal coat, containing fat and diminishing in size and number in the distal pelvic colon.

The wall of the colon is composed of four coats—serosa, muscularis, submucosa, and mucosa.

Serosa.—This is derived from the peritoneum. The descending and iliac portions of the colon, as a rule, are devoid of peritoneum on their posterior surfaces, but the sigmoid flexure has a complete investment. After surrounding the sigmoid, the two leaves of peritoneum coalesce to form the mesentery which anchors this loop to the dorsal wall.

Muscularis.—In common with the rest of the colon, the muscular coat is composed of non-striated fibers in two layers. The fibers of the external layer are grouped in three longitudinal bands or *tæniæ*, each approximately $\frac{1}{4}$ inch wide and nearly equidistant from one another. In the distal half of the pelvic colon, the posterolateral unites with the anterior *tænia* to form a single broad band, which nearly covers its anterior surface, and the posteromedial band spreads out in a similar manner on its posterior surface. As the pelvirectal

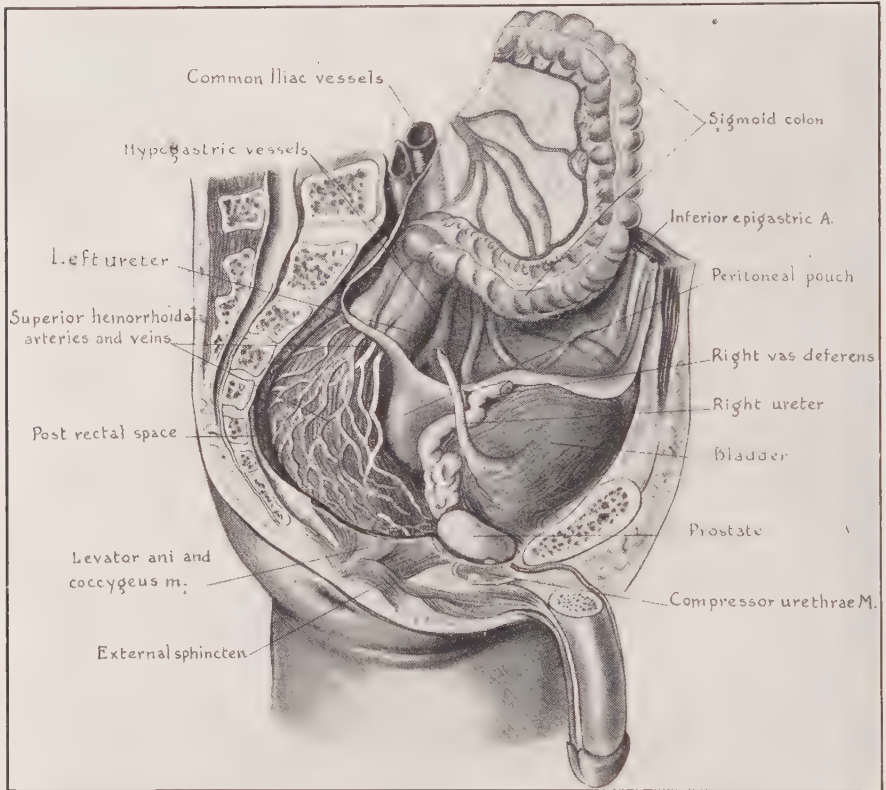


FIG. 29.—ANATOMICAL RELATIONS OF RECTUM AND SIGMOID.
(Semidiagrammatic, after Schultze, *Topographic Anatomie*, Lehmann, München, 1922.)

juncture is approached, the muscle bands coalesce to completely surround the bowel. Here there are no haustra but above small lateral sacculations are found between the two bands.

The haustra or sacculations of the colon are due to the *tæniæ* being considerably shorter than the other coats of the bowel. The internal muscular layer is disposed in a uniform thin coat.

The *submucous* and *mucous* layers do not differ in structure from those of the rectum. The mucosa of the colon, however, contains fewer Lieberkühn

follicles, is thinner and paler than in the rectum, and is closely bound to the muscularis by the submucosa. Solitary lymph-nodes are numerous but its smooth mucosa differs from that of the small intestine in not having valvulae conniventes, villi or Peyer's patches.

Blood Supply.—The inferior mesenteric artery arises from the abdominal aorta about 3 or 4 centimeters above its division into the common iliacs. It crosses the left common iliac artery and descends into the pelvis minor where it is named the superior hemorrhoidal artery which passes between the two layers of the mesosigmoid to end on the beginning of the rectum. About an inch from its origin the inferior mesenteric gives off the left colic artery which divides into two branches. The descending branch anastomoses with the first sigmoid artery. The sigmoid arteries, two or three in number, arise from the inferior mesenteric, but the first sigmoid branch springs equally often from the left colic. The sigmoid arteries supply the iliac colon and the pelvic colon by a series of arcades which anastomose with one another, and above with the left colic and below with the trunk of the superior hemorrhoidal. In the greater portion of the colon the arcades run close to the mesenteric border, but the sigmoidal anastomotic loops are formed some distance from the bowel. From the arcades, branches pass straight to the bowel, encircling it beneath the peritoneum, in general coursing parallel to one another and not anastomosing freely. As a result of this arrangement of the vessels, two points are developed in preserving the blood supply in division of the colon: First, section the bowel obliquely, taking slightly more from the free than from the mesenteric border; and, second, in the pelvic colon, divide the mesentery some distance from its bowel attachment.

A third and most important point is the rectosigmoidal anastomosis. The superior hemorrhoidal is clinically a terminal artery and does not anastomose in arcade fashion with the lowest sigmoid. Hamilton Drummond injected the inferior mesenteric artery *in situ* with barium sulphate and almond oil. The gut was then removed and an x-ray photograph taken (Fig. 30). In twenty cases thus studied he found that the last sigmoid branch of the inferior mesenteric varies considerably in size and has an erratic communication with the next sigmoid branch above. In ten, or one-half of the subjects, the loop was well marked; in eight, too small to insure circulation after ligation of the inferior mesenteric, and in two cases the loop was absent. He concludes:

"1. To insure that the inferior mesenteric artery is tied in a suitable situation, *i.e.*, above the last sigmoid branch, it is necessary to open the abdomen. If the rectosigmoidal loop is small, any attempt to draw down the bowel to the perineum is likely to result in gangrene, and permanent colostomy should be done.

"2. In the abdominoperineal operation for excision of the rectum, it is safe to ligate the inferior mesenteric artery immediately below the point where the left colic artery is given off when a permanent colostomy is made.

"3. If the bowel above is to be brought down to the anus after excision of

the rectum by the abdominoperineal method, the most convenient place to ligature the inferior mesenteric artery is immediately below the first sigmoid branch, which is to be recognized by the large anastomotic loop it usually forms with the left colic artery."

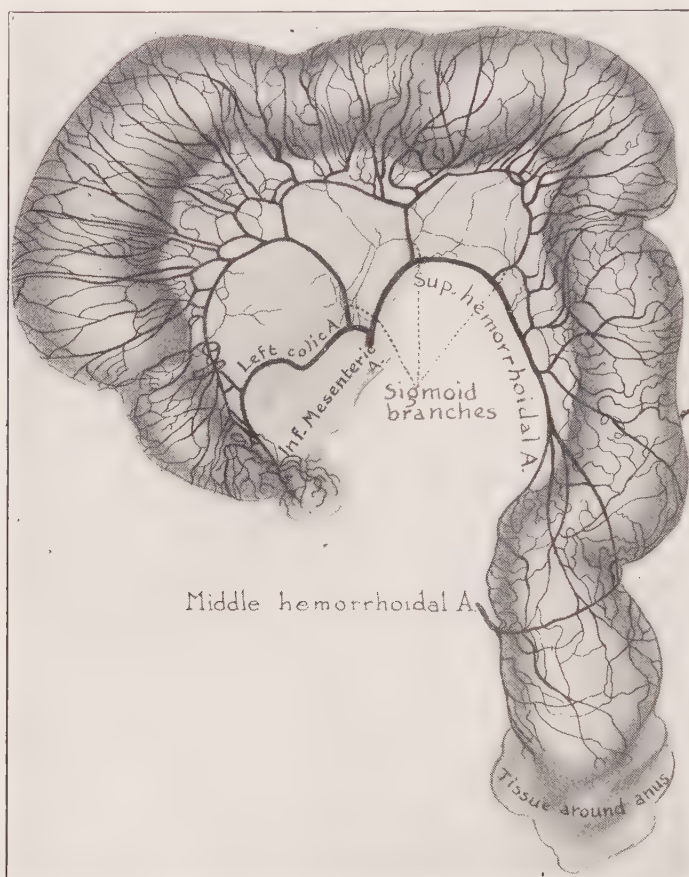


FIG. 30.—ARTERIAL SUPPLY OF THE SIGMOID COLON AND RECTUM, SHOWING DISTRIBUTION OF BRANCHES OF INFERIOR MESENTERIC ARTERY AND THEIR ANASTOMOSES.

From a preparation in *Gray's Anatomy* by Hamilton Drummond. The vessels were injected while the gut was *in situ*; the gut was then removed and an x-ray photograph taken.

Sudeck, in 1907, first showed the necessity of doing a laparotomy to locate the exact position of the rectosigmoidal anastomosis, which he called the "critical point." Two years later Hartmann was the first to apply ligation of the superior hemorrhoidal artery above the last anastomotic loop, a point usually about 2 centimeters below the level of the sacral promontory. In practice this is the point of election in doing the "combined" or abdominoperineal operation for carcinoma of the rectum.

The *veins* of the iliac and pelvic colon correspond to the arteries and empty their blood into the portal circulation through the inferior mesenteric.

Lymphatics.—According to Jameson and Dobson, the lymphatic vessels spring from plexuses in the submucous and subserous coats. In general they follow the course of the blood-vessels and after passing through a group of glands on the root of the inferior mesenteric artery, drain into the lumbar glands. On the wall of the bowel and in the appendices epiploicæ are the epicolic glands. These drain into the paracolic glands which lie between the layers of the mesentery at its attachment to the gut. Efferent lymph-vessels from these are interrupted by intermediate glands situated mostly at the junctions of the arteries in the mesosigmoid. Some lymphatic vessels pass directly from nodes in the bowel wall without meeting the epicolic or paracolic glands. Because of the erratic distribution of the lymphatic vessels removal must be made well beyond the anatomical “lymphatic area” to give reasonable hope against recurrence in malignant disease.

Nerves.—The afferent and chief nerve supply of the iliac and pelvic colon is from the sympathetic system through the superior mesenteric plexus. The nerves are distributed in the wall of the bowel in two plexuses: Auerbach's, between the longitudinal and circular layers of the musculature; and Meissner's, in the submucosa. A few fibers from the spinal cord also reach the bowel through the sympathetic ganglia and plexuses.

Physiology.—The pelvic colon is virtually a way station for the bowel contents, serving as a temporary storehouse. Favoring accumulation of waste material in this segment are its great size and conformation, its dependent position, its angulation, often very acute at its juncture with the rectum, and the neuromuscular apparatus at this point which seems to act in a manner analogous to the pyloric sphincter.

In normal individuals the rectum proper is essentially a passageway and organ of expulsion. Immediately after defecation it is empty, but at other times it contains more or less feces and, in the constipated, the ampulla may be well filled. The anal canal has the dual functions of furnishing an exit for the fecal material and of controlling its discharge. Due to the action of the sphincters and the levator ani muscles the anal canal is quite empty except during the passage of feces or flatus. The external sphincter is the cardinal guardian of the anal canal. Ordinarily the normal passive resistance of the muscles keeps the canal closed, but exercise of the will reënforces the normal passive resistance so that the aperture is firmly closed except at opportune moments.

Defecation.—The direct stimulus to the normal act of defecation is the pressure of the bowel contents on the zone of sensitive mucosa just above the pectinate line. The sigmoid loop rises out of the pelvis, partly obliterating the pelvirectal angle, the sphincter muscles relax and strong waves of peristalsis empty the rectum and lower colon and, by syphon action, also carry along the softer contents of the descending colon, so that normally one would expect the bowel to be evacuated beyond the splenic flexure at least. Assisting the act is a

low toilet seat, bringing the thighs nearer the abdomen; a deep inspiration to hold the diaphragm fixed in a low position, and powerful contraction of the abdominal muscles which compress the small intestine against the distal colon and rectum. The diaphragm and abdominal muscles, of course, are purely voluntary.

The spinal "defecation" center is in the tip of the cord at about the level of the base of the first lumbar vertebra. The voluntary inhibitory center is situated in the brain. Injury or disease which renders the reflex spinal cord center inactive results in rectal incontinence. The feces are expelled as soon as they enter the rectum and the sphincter relaxes on the examining finger. If the injury in the cord is proximal to the defecation center, and involves the volitional tract, and the reflex nervous mechanism is intact, feces, impinging on the sensitive area of mucosa above the pectinate line, are passed reflexly. An intact spinal center and efferent motor nerves may be recognized by contraction of the external sphincter on the examining finger. If the sensory tract in the cord is also involved the patient is not conscious of the bowel action; if the sensory path is not implicated, he is aware of the process but unable to control it (Gowers).

Fluoroscopy demonstrates reverse peristalsis in the cecum, ascending and proximal transverse colons, but it probably does not occur regularly beyond the splenic flexure. Roith and Schwartz have observed that anastalsis (reverse peristalsis) may occur in the pelvic colon.

Secretion and Absorption.—The rectum and pelvic colon take no part in digestion. However, the numerous goblet-cells of the mucosa secrete mucus for lubrication of the feces and in pathologic conditions may yield a large excess. The other important function of the mucosa is absorption through Lieberkühn's follicles. Absorption of water from the bowel contents leaves a residue which tends to become drier and more formed the longer it is retained. The absorptive function is utilized in practice for medication and to increase the fluid contents of the body. For the latter purpose, tap water, physiological saline solution and glucose solution are used. Owing to their rapid absorption, certain medicines are also introduced into the rectum to obtain their constitutional effect, notably belladonna, and opium.

When, for any reason, food cannot be ingested, nutrient enema may be temporarily useful in tiding over the crisis. This method of feeding is less popular than formerly, as other methods are more certain and efficient, *e.g.*, transduodenal feeding, hypodermoclysis, and glucose solution intravenously.

REFERENCES

- Cunningham's Text-book of Anatomy*, 5th Ed., London, H. Frowde, 1922.
 DRUMMOND, Hamilton. *Brit. J. Surg.*, Bristol, 1914, Vol. 1, No. 4.
Gray's Anatomy, 22d Ed., London, Longmans & Co., 1923.
 HARTMANN, H. *Ann. Surg.*, Phila., Dec., 1909.
 JAMESON and DOBSON. *Proc. Roy. Soc. Med.*, Lond., 1909, Vol. 2.
 SUDECK, P. *München. med. Wchnschr.*, 1907, p. 1314.

CHAPTER II

EMBRYOLOGY AND DEVELOPMENTAL DEFECTS OF RECTUM AND ANUS

EMBRYOLOGY

After fertilization of the ovum, the cell, by a process of repeated division, undergoes segmentation and develops a cavity filled with fluid, within the mass of cells. At one point of this cellular membrane, *blastoderm*, the cells become aggregated, forming the germinal area or *embryonic shield* from which the entire individual develops. Very early the cells of the germinal area differentiate into three layers: Outer, epiblast or ectoderm; middle, mesoblast or mesoderm; and inner, hypoblast or entoderm.

A narrow plate of modified ectoderm, stretching along what will be the future median dorsal line of the body, becomes depressed, thus forming the floor of a groove, the elevated margins of which fuse in the midline and form the *neural tube*, out of which are developed the brain and spinal cord.

The mesoderm on each side of the chorda dorsalis undergoes cleavage by the development of spaces which coalesce to form the *cœlom* or body-cavity, which subsequently becomes divided into the pleural, pericardial and abdominal cavities. The outer layer of mesoderm, together with the ectoderm, forms the *somatopleure*, or body wall; while the inner layer is closely applied to the entoderm to form the *splanchnopleure*, or wall of the primitive intestinal canal (archenteron).

While the neural tube is forming by the inversion of the epiblast, the folds of splanchnopleure, indenting the yolk-sac proximally, produce a ventral furrow, the *primitive intestinal groove*. As development proceeds this groove is constricted from the yolk-sac, anteriorly and posteriorly, forming the embryonic closed gut which communicates freely by the *vitello-intestinal duct* (yolk-stalk) with the yolk-sac. Normally the last two structures soon atrophy but the vitello-intestinal duct may persist and develop as a blind pouch of the small intestine—Meckel's diverticulum—in 2 per cent of individuals.

After closure of the body-cavity and intestinal tube, the embryo straightens out and the alimentary canal extends as a straight tube from the cephalic to the caudal end of the embryo. The oral closed culdesac represents the primitive fore-gut, but the caudal pouch, the primitive hind-gut, communicates for some weeks with the nerve tube by the *neurenteric canal*. The epiblast superficial to these blind ends invaginates forming cephalically the *stomodeum* and caudally the

proctodeum. The floor of these depressions ultimately breaks through to form the mouth and anus, respectively.

The primitive mid-gut is represented by that portion of the archenteron corresponding to the attachment of the yolk-stalk which divides the alimentary tube into three functional parts:

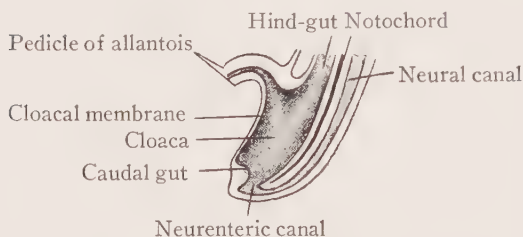


FIG. 31.—SUCCESSIVE STAGES IN DEVELOPMENT OF ANUS AND RECTUM.

(After Stieda. Yeomans in Cooke, *Diseases of the Rectum and Anus*, Courtesy F. A. Davis Co.)

from the point of entrance of the common bile-duct to the splenic flexure of the colon.

(c) Hind-gut, supplied by the inferior mesenteric artery and chiefly excretory in nature, extends from the splenic flexure to the anus.

One or the other of these embryological divisions may fail to develop. For instance, the portion beyond the splenic flexure may be represented by an impervious cord; constriction or occlusion may occur at the site of juncture of successive portions as in the duodenum and at the splenic flexure.

While the embryo is very young, there occurs an entodermal evagination or outgrowth from the posterior portion of the intestinal tube, called the *allantois*. In the third embryonal week the hind-gut ends in a dilated chamber, common to it and the allantois, named the *cloaca*, into which open the paired wolffian bodies or primitive kidneys through the mesonephric ducts.

The anal aperture is formed at a point cephalad to the neurenteric canal, hence the terminal portion of the embryonal hind-gut is named the *postanal gut*. This usually disappears in the second embryonal month, but may persist as a congenital posterior rectocele, or from its remnants, certain congenital cysts and tumors may originate in the sacrum and coccygeal span. The neurenteric canal is usually obliterated before the postanal gut, but very exceptionally persists as an abnormal sacral outlet of the rectum.

(a) Fore-gut, supplied mainly by the celiac axis and serving the preparatory purposes of digestion, extends from the pharynx to the duodenum at the point of entry of the common bile-duct.

(b) Mid-gut, supplied by the inferior mesenteric artery and serving for the main part of the functions of digestion and absorption, represents the intestine

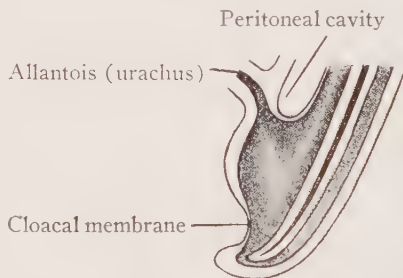


FIG. 32.—SUCCESSIVE STAGES IN DEVELOPMENT OF ANUS AND RECTUM.

(After Stieda. Yeomans in Cooke, *Diseases of the Rectum and Anus*, Courtesy F. A. Davis Co.)

"Seeing that the embryonic tissue, which gives rise to the caudal end of the body, lies in the posterior lip of the neurenteric canal, it is not difficult to conceive that embryological remnants might persist in the sacrococcygeal region of the pelvis, and give rise to teratomatous tumors" (Keith) (Fig. 33).

Cloaca.—The entodermal cloaca pushes aside the mesoderm and approaches the surface, finally fusing. This area of fusion, known as the *cloacal membrane*, consists, therefore, of two layers of epithelial cells—a stronger entodermal and a weaker ectodermal—and forms a septum between the cloaca and a shallow surface depression styled the urogenital fossa or ectodermal cloaca (Fig. 31).

By proliferation of the entoderm and mesoderm the urorectal septum is formed which divides the cloaca into a dorsal (rectal) and a ventral (allantoic or urogenital) portion. This partition is closely followed by the peritoneum, forming the rectovesical culdesac (Fig. 34).

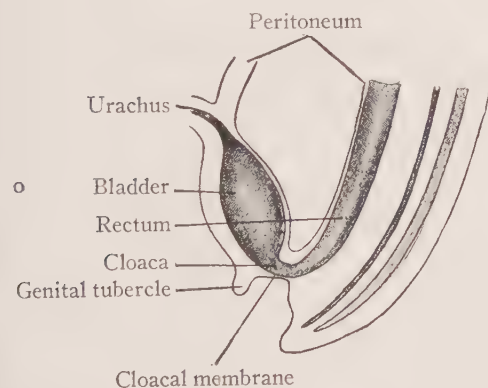


FIG. 34.—SUCCESSIVE STAGES IN DEVELOPMENT OF ANUS AND RECTUM.

(After Stieda. Yeomans in Cooke, *Diseases of the Rectum and Anus*, Courtesy F. A. Davis Co.)

dorsal portion of the cloaca becomes the rectum (Fig. 35).

Before partition of the cloaca, the mesonephric (wolffian) ducts empty into its ventral portion; after division they open into the urogenital sinus. That portion of the proximal intra-abdominal allantois entering into the formation

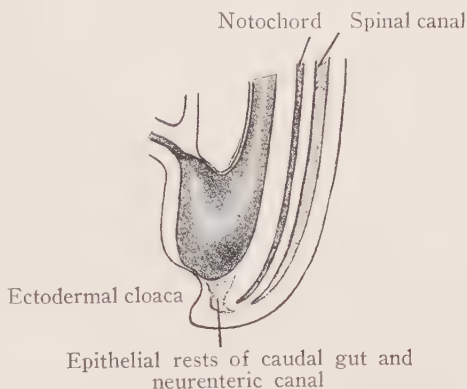


FIG. 33.—SUCCESSIVE STAGES IN DEVELOPMENT OF ANUS AND RECTUM.

(After Stieda. Yeomans in Cooke, *Diseases of the Rectum and Anus*, Courtesy F. A. Davis Co.)

Fusion of the tissues of the urorectal septum with the cloacal membrane forms the primitive perineum and divides the membrane into two parts—a ventral urogenital membrane, closing the urogenital sinus, and a dorsal membrane, closing the rectum.

If the urorectal membrane fails to fuse completely with the cloacal membrane, the so-called cloacal duct persists and the rectum communicates permanently with the bladder. From the ventral portion of the cloaca develop the bladder, the prostatic and membranous portions of the urethra and the urogenital sinus as far as the cloacal membrane. The

of the urogenital sinus persists and dilates to form the urinary bladder. The rest of the allantois (allantoic duct) degenerates into the urachus. More recent

investigations seem to show that the allantois contributes nothing to the definitive urinary bladder.

The müllerian ducts develop from the coelomic epithelium quite independent of the intestinal tract. Together with the wolffian ducts, they are imbedded caudally in a mass of tissue termed the genital cord. At the eighth week, approximately, the müllerian ducts fuse in their lower part, the intervening septum is absorbed, and the uterovaginal canal thus formed extends

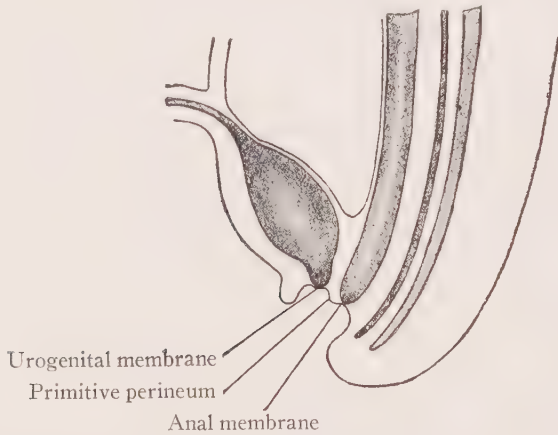


FIG. 35.—SUCCESSIVE STAGES IN DEVELOPMENT OF ANUS AND RECTUM.

(After Stieda. Yeomans in Cooke, *Diseases of the Rectum and Anus*, Courtesy F. A. Davis Co.)

as a tube parallel to the posterior wall of the bladder and urethra, to fuse with the epithelium of the posterior wall of the urogenital sinus. The lower fused portions of the müllerian ducts represent in the female the future uterus and vagina; while their upper free portions become the fallopian tubes.

Meanwhile the urogenital sinus has shortened, bringing the point of fusion nearer the surface, so that finally, when the fused blind end of the uterovaginal canal breaks through, the orifice is superficial and the urogenital sinus becomes the vestibule of the vagina. In the male, the müllerian ducts persist only as the vestigial sinus pocularis; in the female, the wolffian ducts, from which the epididymis and ductus deferens of the male develop, remain vestigial.

External Genitalia.—The cloacal membrane, as previously described, is located in a ventromedial groove and is divided by the primitive perineum into

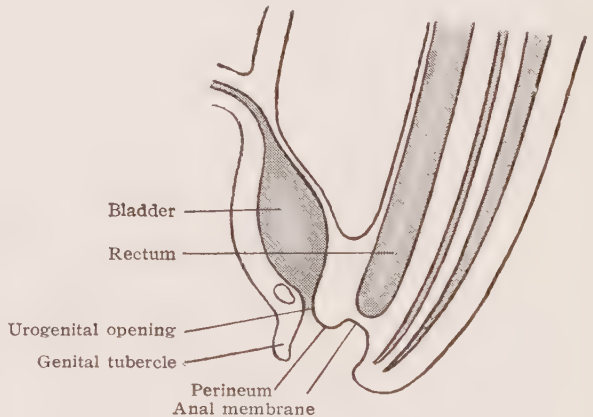


FIG. 36.—SUCCESSIVE STAGES IN DEVELOPMENT OF ANUS AND RECTUM.

(After Stieda. Yeomans in Cooke, *Diseases of the Rectum and Anus*, Courtesy F. A. Davis Co.)

a cephalic urogenital membrane and a caudal anal membrane. By the coalescence of this groove in the region of the perineum so as to form a raphé, the permanent perineum results (Fig. 36). Extending forward from the perineum on each side of the groove are two ridges known as the internal and

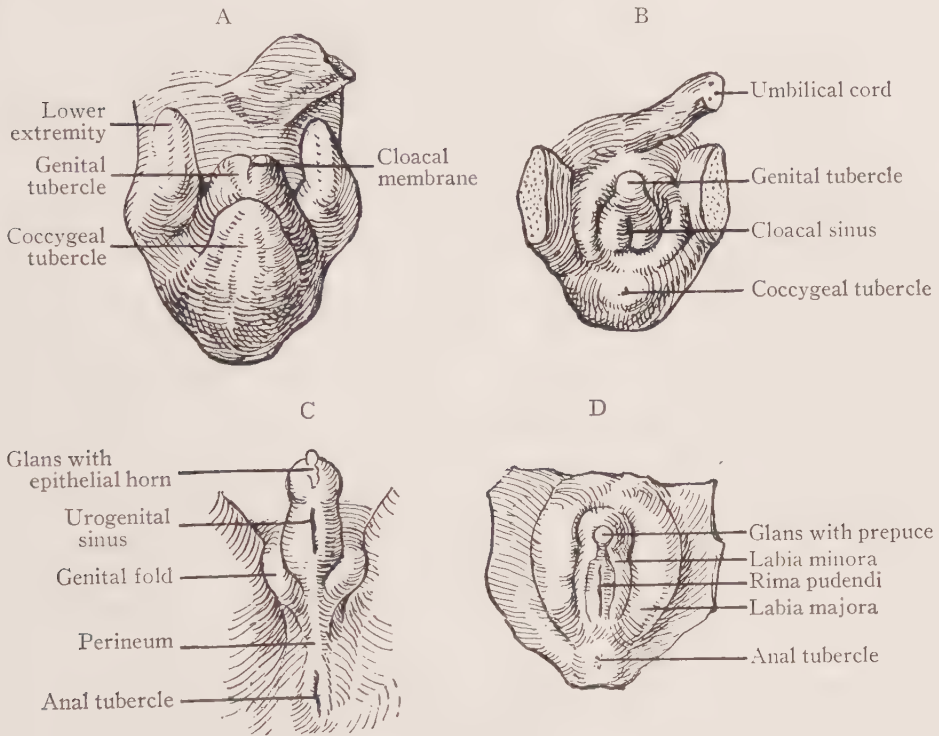


FIG. 37.—DEVELOPMENT OF EXTERNAL GENITALS.

- A. Male embryo of 17 millimeter vertex-coccygeal length. (After Kollmann.)
 B. Male embryo of 23 millimeters vertex-coccygeal length. At each side of the genital tubercle are two elongated elevations, the genital folds. (After Kollmann.)
 C. Male fetus of 5 centimeters vertex-coccygeal length, enlarged six times. The closure of the urogenital sinus has advanced to the anterior half of the base of the penis, but does not yet reach the free glans. The line of closure is marked by a raphé in the perineum, and is represented on the glans by an epithelial horn. (After Tourneux.)
 D. Female fetus of 15 centimeters vertex-coccygeal length (sixteen weeks), enlarged three times. The more developed labia minora cover almost the entire glans clitoridis, thus forming the prepuce clitoridis. Between the margins of the labia minora is the sinus urogenitalis, with the urethra in its fore part and the hymen in its back part. The external genital folds have now developed into the labia majora. (After Kollmann.)
 (Yeomans in Cooke, *Diseases of the Rectum and Anus*, Courtesy F. A. Davis Co.)

external genital folds. These unite in front to enclose an epithelial eminence, previously formed, called the genital tubercle (Fig. 37-A).

Until the beginning of the third month the external genitalia are undifferentiated (Fig. 37-B). Then, in the male, the genital tubercle elongates to form the penis, the inner genital folds fusing to form the urethra, and the outer genital

folds contribute the skin of the perineum and scrotum. The raphé marks the line of union (Fig. 37-C).

In the female embryo the genital tubercle grows downward and remains comparatively small, forming the clitoris; the inner genital folds become the nymphæ, between which the vagina opens. The labia majora and perineal skin are derived from the outer genital folds (Fig. 37-D).

Anal Canal.—The anal opening is established during the third embryonal month, some days later than the completion of the urogenital perforation. The latter is preceded by the formation of a transverse ectodermal reduplication, producing a depression called the transverse anal fissure. Ridges of mesoderm surrounding the anal orifice further deepen the ectodermal depression until a distinct depression results, known as the proctodeum, which grows as a funnel-shaped fossa toward the blind termination of the end gut. The intervening mesoblast is compressed and pushed aside or absorbed, so that finally a septum is formed consisting only of the ectodermal epithelium of the proctodeum and the entodermal epithelium of the rectum. With the absorption of this septum, the rectum and anus become continuous. This zone of perforation is of great significance in proctology, as it marks the upper limit of the anal canal and the lower limit of the rectum as well as the point of transition from mucosa to mucocutaneous tissue, and is called the pecten (Stroud).

Thus embryology demonstrates that the rectum proper is developed from the hypoblast and mesoblast in common with the rest of the colon; its mucosa from the hypoblast, its submucosa and muscularis from the inner fold of the mesoblast; and that developmentally and practically the rectum ends at the serrated margin of the pecten. The anus develops independent of the rectum; its lining from the epiblast, its muscles and fascia from the outer layer of the mesoblast, and includes all that portion of the intestinal tract below the upper margin of the pecten. The pecten is an important landmark as the membranes, the glands, the nerve and blood supply undergo a rather abrupt change at this point and the diseases encountered in the two portions are almost as distinct.

DEVELOPMENTAL DEFECTS

Incidence.—Congenital anomalies of development of the terminal bowel are of rare occurrence. Usually they are very serious and at first may be overlooked unless the accoucheur, in his systemic examination of the newborn, detects the anomaly and institutes proper measures for its relief at the most favorable time. Approximately one of every five thousand babies presents at birth an anorectal defect of development. In seventy-eight thousand births collected by Cripps, the incidence was one in 4,588. As cases occurring in private practice are frequently not reported, the most reliable statistics are those of large maternity hospitals.

Some years ago, the author collected the statistics of several New York hospitals. From January, 1890, to 1913, there were 81,700 births at the

Lying-In Hospital, seventeen of which presented malformations of the anus or rectum. In the period of seven years (1905-1912), 7,239 babies were born at the Manhattan Maternity and Dispensary. Two of these presented anorectal atresia and three others had serious malformations of the small intestine and colon.

Sex.—In general, the ratio of the anomalies in males to females is about five to three. Of the forty-five cases personally collected by the author, thirty were males, thirteen females, the sex in two not being stated. Furthermore, the proportion of the very serious forms of malformation is higher among males.

Etiology.—Studies in embryology are now capable of explaining almost all of the congenital malformations of man on the basis of developmental defects. These disturbances of development probably have their inception during the first month of embryonic life. The vast majority of anorectal defects result from irregular or arrested development of the proctodeum, the rectum or the urogenital septum.

The resulting malformations conform to the following types:

1. Epiblast does not invaginate at anal site; anal canal absent. Rectum normal or absent in whole or in part; no function.
2. Rudimentary or developed anus, partly or completely occluded by persistent anal membrane. Rectum normal, partly or totally absent.
3. Postallantoic gut is undeveloped, does not descend and ends blindly. No function.
4. Postallantoic gut descends, but grows backward out of alignment with the proctodeum and the intervening tissues are not absorbed. No function.
5. Urorectal partition of cloaca is arrested and rectum communicates with bladder, urethra, uterus, vagina or perineum. Anus usually completely closed. Function restricted.
6. Urogenital outlet in rectum; ureters or vagina opening into rectal cavity; anus and rectum normal.
7. Persistence of neurenteric canal with opening of postanal gut in sacral region.

Imperforate Rectum

This anomaly is comparatively common. The rectum may be absent or is arrested in its descent. Arrest may occur at any point below the sacral promontory, but in the majority of cases the bowel ends blindly at the level of the peritoneal reflection, which in females is approximately 2 centimeters above the perineum and in males 0.5 to 1 centimeter higher.

Again, in some cases, the rectum may descend lower than the apex of the invaginated proctodeum, but lies in a more posterior plane and coalescence does not take place. In non-descent, a fibromuscular cord may extend from the blind end of the rectum to the anal pouch, bladder or urethra. Embryology explains

the nature of this cord as remnants of the mesoblast from which the muscular and connective tissue layers of the colon are derived. The mucosa, derived from the hypoblast, for some unknown reason fails to descend equally with the derivatives of the mesoblast. Consequently the latter, instead of enclosing a lumen, form a cord composed of connective tissue and muscular elements, but in no residual epithelial cells which the microscope would demonstrate had the mucosa

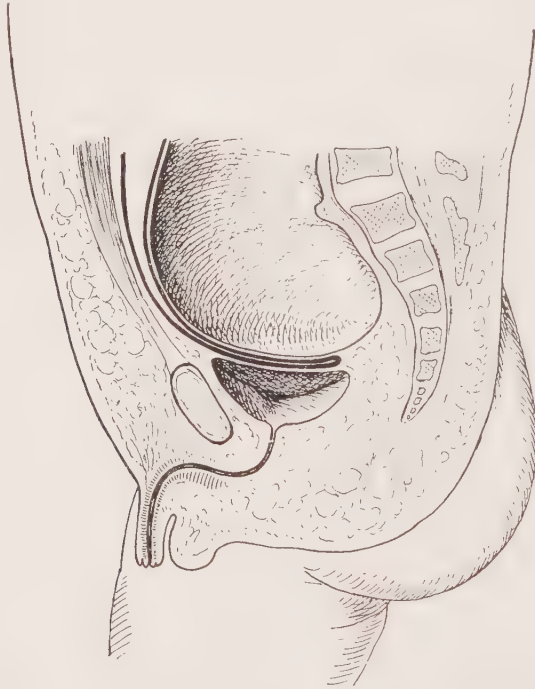


FIG. 38.—IMPERFORATE RECTUM, ANUS ABSENT.
(Yeomans in Cooke, *Diseases of the Rectum and Anus*, Courtesy F. A. Davis Co.)

ever been present. In rare instances the lumen of the rectum may be partly occluded by adhesion or agglutination of its mucosa, or by thin, annular, membranous septa.

Occasionally anomalies of the pelvic bones, such as absence of the coccyx or malformed sacrum, are associated with imperforate rectum, indicating a general disturbance of development of the hind-end of the embryo.

Diagnosis

In this, as in all other anorectal malformations, a correct diagnosis can usually be made by careful physical examination. Absence of meconium is usually the first symptom to attract attention, especially if the anus is well formed. The anus may be absent, or the anal canal end blindly, arresting

the lubricated little finger at a depth of 1 to 1½ centimeters. When the rectum is low and in line with the anal canal, an impulse is conveyed to the examining finger when the child cries or counterpressure is made over the hypogastrium. Associated malformations of the bony framework of the pelvis are suggestive and the urine is observed for meconium. Unless an outlet is established promptly, the classic picture of intestinal obstruction quickly supervenes: Abdominal dis-



FIG. 39.--FIBROUS CORD LEADING FROM THE ANUS TO THE ARRESTED RECTUM.

tention and later vomiting, refusal of food, marked prostration and frequently jaundice.

A few cases of congenital intestinal volvulus have been disclosed at autopsy. The symptoms are the same as those of imperforation, but the treatment is different. For this reason, if occlusion is not certain, one should always attempt to inject water through the anal canal.

Imperforate Rectum with Vaginal Outlet.—Congenital rectovaginal fistula is the more common form of abnormal outlet, accompanying imperforate anus or rectum. In the vast majority of these cases the outlet is in the vulva, and should be so classified. Very few examples are recorded of rectovaginal communication above the vestibule, and then usually by a very narrow tract. In only two reported cases did the rectum communicate with the uterus, the tracts in both instances being narrow.

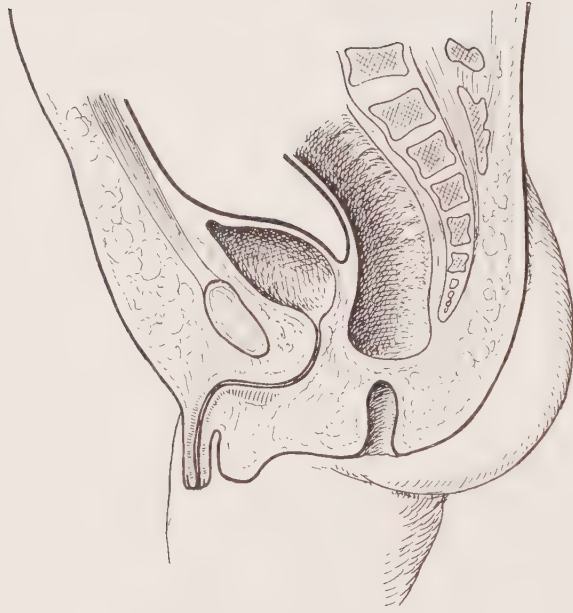


FIG. 40.—IMPERFORATE RECTUM, ANAL CANAL WELL FORMED.
(Yeomans in Cooke, *Diseases of the Rectum and Anus*, Courtesy F. A. Davis Co.)

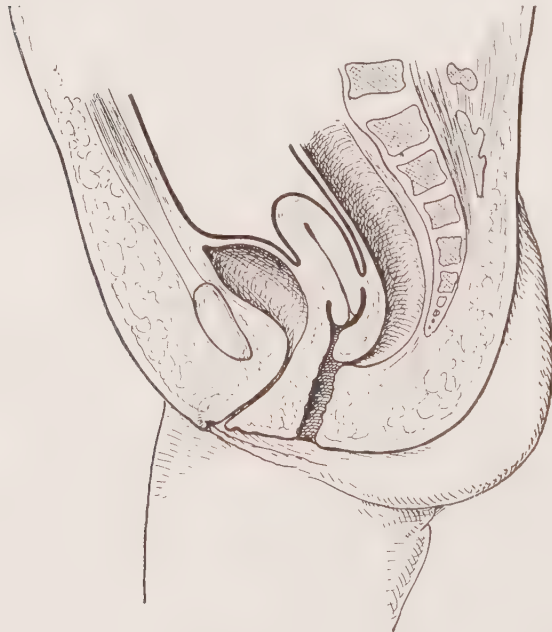


FIG. 41.—IMPERFORATE RECTUM, VAGINAL OUTLET.
(Yeomans in Cooke, *Diseases of the Rectum and Anus*, Courtesy F. A. Davis Co.)

Failure of fusion and orderly absorption of the septum of the müllerian ducts may result in anomalies of development of the urogenital tract, such as uterus didelphys or double vagina, which may accompany rectovaginal or recto-uterine fistula. In Hinckle's unique case, a healthy woman, aged sixty-two years, there were two vaginæ, two well-developed clitorides, two urethræ, double uterus, two well-developed anuses about 3 inches apart, two rectums which did not communicate with each other, and fluoroscopy demonstrated two separate colons as far as the cecum. Cystoscopy showed two distinct bladders with a single ureteral opening in each.

Imperforate rectum with vaginal outlet presents the same symptoms and physical signs as given for simple imperforate rectum plus scant dribbling of meconium from an opening in the vagina above the vestibule.

Imperforate Rectum with Vesical Outlet.—This is a rare malformation. Owing to the interposition of the uterus and vagina, congenital rectovesical or recto-urethral fistula is exceptional in females. Of the forty-five cases collected by the writer, none presented this anomaly. Fitchet reported one instance of rectovesical communication in a male among thirty-one cases of anorectal malformation treated in the Massachusetts General Hospital during a period of fifty-two years (1873-1926). The tract, lined with mucosa, is usually very narrow and tortuous, and opens into the trigone or nearer the fundus. Symptoms of ileus occur early and, due to the presence of feces in the bladder, cystitis and ascending pyelitis soon develop with fatal issue.

The diagnosis is made by the physical signs of simple imperforate rectum plus urine stained or heavily loaded with meconium. Theoretically the meconium should pass only with the urine when the opening is in the bladder, while oozing would be constant were the opening in the urethra, a point of differentiation practically impossible to determine in the newborn.

Imperforate Rectum with Urethral Outlet.—This comparatively rare anomaly is more common in males. The communicating tract, lined with mucosa, opens into the prostatic or, more frequently, into the membranous urethra. Usually the tract is very narrow but may be large enough to drain the bowel adequately. Cases have been reported in which the victims attained maturity, always defecating per urethram.

The diagnosis is made on the more or less constant oozing of meconium and bubbling of flatus from the urinary meatus. Cystitis is absent. If the tract is sufficiently broad, symptoms of intestinal obstruction may be delayed, and the prognosis correspondingly better. If thorough drainage of the feces through the natural passage is established by operation on the imperforate rectum, following relief of pressure, there is a tendency to spontaneous closure of the congenital communication with the urethra.

Case.—W. W., Jr., aged twenty months, in apparent good health, well nourished, weight 29 pounds. Imperforate rectum was opened through anal dimple on day of birth. Rubber tube worn one year. Mother passed bougies daily thereafter, but with increasing difficulty. Soon after birth feces in small

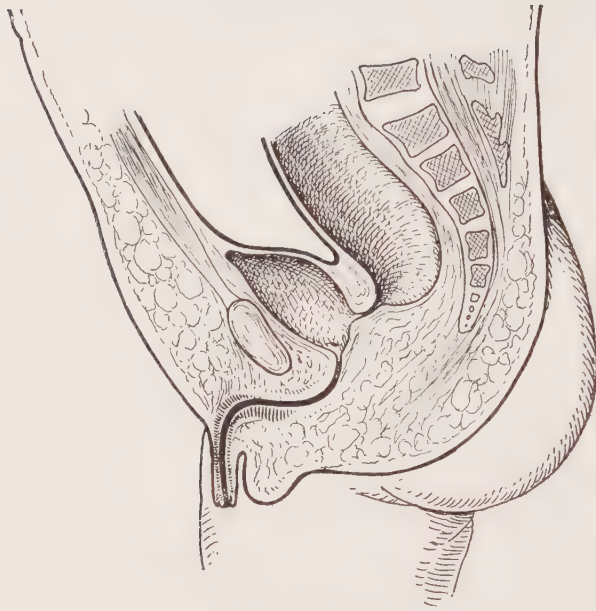


FIG. 42.—IMPERFORATE RECTUM, VESICAL OUTLET.
(Yeomans in Cooke, *Diseases of the Rectum and Anus*, Courtesy F. A. Davis Co.)

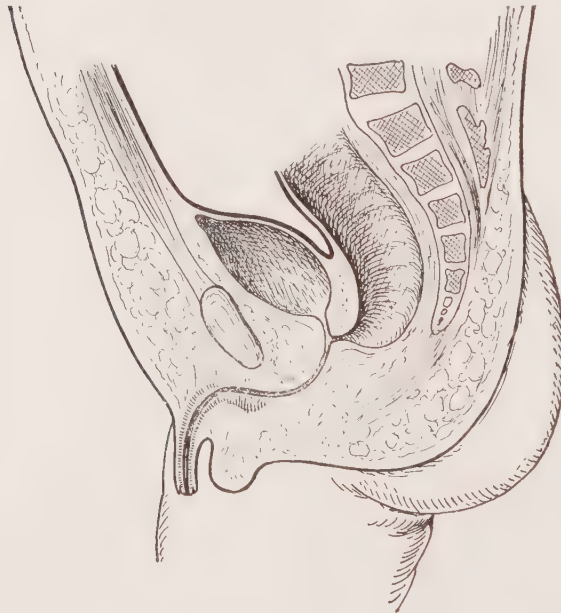


FIG. 43.—IMPERFORATE RECTUM, POSTERIOR URETHRAL
OUTLET.
(Yeomans in Cooke, *Diseases of the Rectum and Anus*, Courtesy F. A. Davis Co.)

quantities passed through the urethra, and recently almost equal amounts were evacuated through urethra and rectum. Urine was clear. Methylene-blue injected into rectum appeared promptly at urinary meatus. The anus was formed, but sphincter poorly developed. An annular fibrous stricture 2 centimeters long began just above the sphincter. A No. 3 Wales bougie could be passed with difficulty. Sodium iodid solution injected per urethram filled the bladder but did not enter the rectum. Roentgenograms after a barium meal and clysma indicated that the rectum opened into the posterior urethra, but this was by a channel so narrow that it would not retain the contrast material (Fig. 44).

On April 27, 1928, under light ether anesthesia, the stricture was incised freely in the posterior midline; the incision was packed tightly with gauze strips and a large rubber tube was inserted into the rectum. After a free exit was thus established, feces practically ceased to escape by the urethra. It is expected that bougies will maintain unobstructed rectal function and that the congenital recto-urethral fistula will close spontaneously. Encouraging this hope is the fact that seven months after operation only when the stools are liquid do any feces appear through the urethra.

Imperforate Rectum with Spinal Outlet.—This very rare anomaly is explained by persistence of the neurenteric canal which closes normally very early in the embryo. Ball cites the case of a child a few months old with imperforate rectum and spina bifida, at the side of which the bowel opened.

Urogenital Outlet in Rectum.—A developmental defect converse to the rectum communicating with the genito-urinary tract is the opening of the vagina, uterus or ureters into the rectum. Bodenhamer collected nine cases in which the vagina opened into the rectum and seven in which the ureters ended there also. The vaginal cases are apt to be overlooked until puberty. Then the condition is easily recognized. In the observed cases where the ureters were implanted in the rectum, the ureteral openings were at the peritoneal reflection and the bladder was absent. Operative treatment is impossible, but the rectum acquires a peculiar tolerance of the urine so that renal infection may be delayed for a considerable period.

Atresia Ani.—Arrest or irregular development of the proctodeum may result in the following anomalies:

(a) Anus totally absent due to complete failure of the proctodeum to invaginate.

(b) Membranous occlusion, partial or complete. The well-formed anus ends in a blind pouch, due to partial or total failure of the anorectal membrane to be absorbed.

(c) Congenital narrowing of the anal canal. In this form of atresia the anal canal is continuous with the rectum, but is of too small caliber for efficient function.

Total Absence of Anus.—This is the most usual type of anal malformation. The median raphé may extend in an unbroken line to the coccyx, or the site of

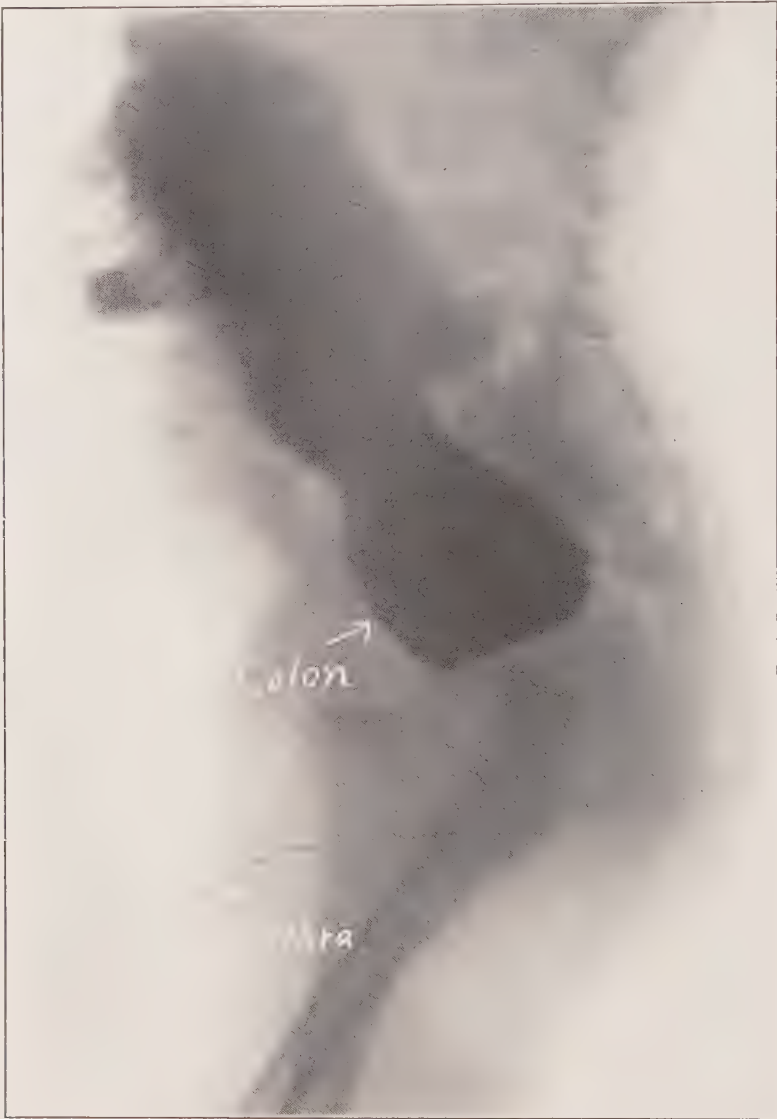


FIG. 44.—IMPERFORATE ANUS, RECTUM OPENING INTO URETHRA.

Boy, aged twenty months. Roentgenogram of colon injected with barium, the urethra with sodium iodid solution.

the normal anus may be marked by a dimple, a pigmented area or a corrugated elevation of skin. The external sphincter muscle may be normal, rudimentary or replaced by dense fibrous tissue. The position of the rectum in these cases varies. It may be imperforate, descent arrested, with or without an adventitious opening, but in the great majority of cases it is normally developed, intrapelvic,

and situated just beneath the skin. The latter is of prime practical importance, suggesting, as it does, primary search for the rectum through the perineum. Bulging of the perineum or a palpable impulse when the child cries definitely suggests that the distended rectum is in close proximity to the perineum. On the other hand, if investigation discloses that the vagina or bladder occupies the concavity of the sacrum, the rectum ends at a high level. Likewise abnormal narrowing of the interischial space to less than 2 centimeters for an infant of normal size is suggestive that the rectum is extrapelvic.

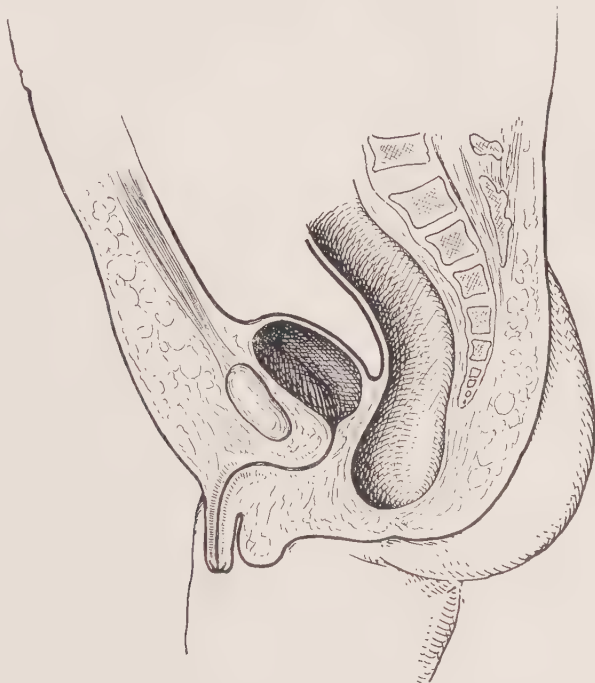


FIG. 45.—IMPERFORATE ANAL CANAL.

(Yeomans in Cooke, *Diseases of the Rectum and Anus*, Courtesy F. A. Davis Co.)

If overlooked at birth, absence of meconium, refusal of nourishment, abdominal distention and vomiting quickly supervene. Simple inspection discloses the condition.

Membranous Occlusion of Anus.—At birth the anal canal is approximately 1.5 centimeters in length and the occluding membrane may be situated at any level below this point to 0.5 centimeter above the anal margin.

In a typical case of *complete occlusion* the anal pouch is normally developed, but the anorectal membrane persists as a very thin elastic diaphragm of fibrous or mucocutaneous tissue at the pectinate line. Constipation is absolute and if the rectum is normal, the examining finger feels an impulse or fluctuation of the distended bowel, or rarely the thin membrane may be seen protruding through



FIG. 46.—PARTIAL OCCLUSION OF THE ANUS.

(After Ball, Yeomans in Cooke, *Diseases of the Rectum and Anus*, Courtesy F. A. Davis Co.)

the anus when the child cries. These findings are absent when the axes of the anal pouch and rectum do not coincide, or when the rectum is imperforate, and represented only by a fibromuscular cord prolonged to the apex of the funnel-shaped anus.

In *partial occlusion* the anorectal membrane, partly absorbed, is annular or crescentic in shape. Correspondingly the perforation is central or lateral and large, or so small as to barely admit a probe.

A partial persistence of the primitive proctodeum may result in a partial occlusion by a superficial band of skin crossing the anus as an unbroken median raphé, or as a transverse bridge, with small passages leading into the anal canal on one or both sides, lined with epithelium.

A *congenital narrow anal canal* is due to faulty development of the proctodeum and is to be distinguished from a stricture which generally implies a pathologic process. The canal may be congenitally narrowed in one portion only or throughout. While the feces

are soft, symptoms may be absent, but with age the solid feces irritate the tissues of the inefficient canal, superimposing a true fibrous stricture on the congenital constriction.

Constipation and straining indicate a digital examination. The anal canal at birth should permit the introduction with comparative ease into the rectum of the examiner's little finger, which readily distinguishes the normal elastic structures composing its walls from the firm fibrous tissue, the result of inflammation.

Imperforate Anus with Vulval, Perianal, Scrotal, Anterior Urethral or Suburethral Outlet.—According to Keibel and Mall, all of these anomalies are due to persistence of the cloacal duct. As a result of inclusion by the genital folds the duct is encircled instead of being obliterated as normally occurs.



FIG. 47.—MEMBRANOUS OCCLUSION OF THE ANUS.

Imperforate anus with vulval outlet is a common type of malformation and, of the class presenting adventitious openings, it is the most usual form. True rectovaginal fistula is very rare, most of the cases so classified opening into the fourchet. The opening may be small, but in some cases it is adequate for defecation and surrounded by an efficient sphincter, so that its victims may go through life ignorant of their deformity.

Morgagni reported the case of a woman who lived one hundred years, bore several children and was not aware of her abnormality. The lowest portion of

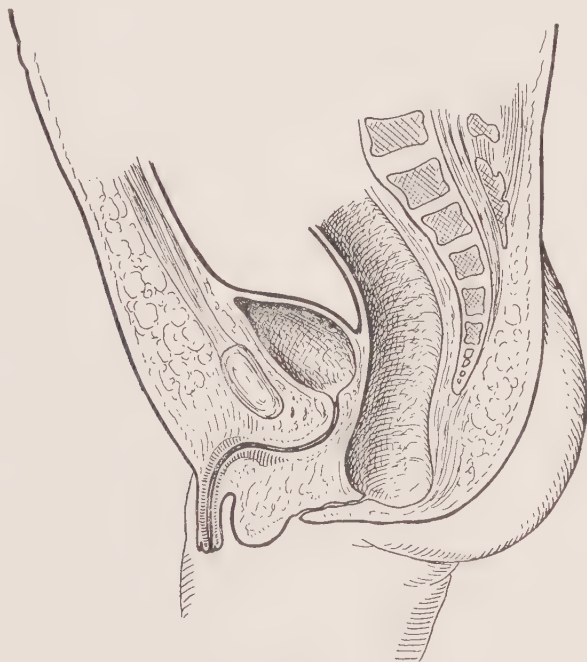


FIG. 48.—IMPERFORATE ANUS, OPENING IN PERINEUM.
(Yeomans in Cooke, *Diseases of the Rectum and Anus*, Courtesy F. A. Davis Co.)

the rectum may terminate in the opening, but usually there is posteriorly a dilated rectal culdesac.

MacKenzie reported the interesting case of a girl, aged twenty-three months, in whom "urethra, vagina and anal passage still open, as in the young embryo, into a common entodermal cloaca, but with the difference that the urinary and genital canals are entirely separate from each other" (Fig. 49).

Imperforate anus with opening in perineum, scrotum, anterior urethra, prepuce or under surface of penis are comparatively rare anomalies. In none of these cases is the fistulous tract of adequate size for permanent drainage of the rectum. When gas bubbles and meconium dribbles from the prepuce, it is important to determine whether the opening is in the anterior or the posterior urethra. In the latter instance, the rectum is imperforate.

In recto-urethral fistula, in the male, meconium dribbles independent of micturition. The first portion of urine passed may be stained with meconium,

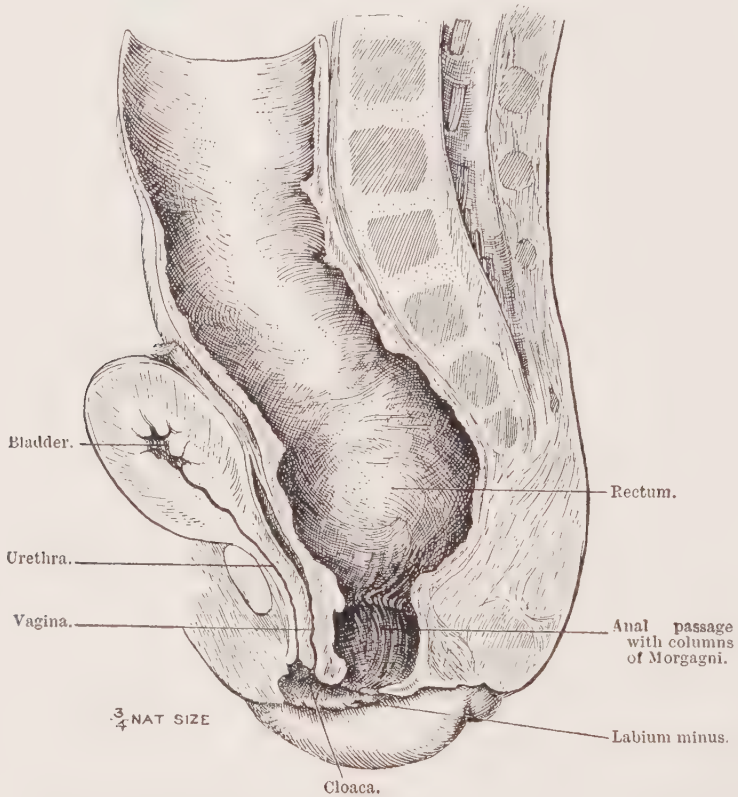


FIG. 49.—IMPERFORATE ANUS, OPENING INTO A CLOACAL CHAMBER.

(After Mackenzie. Yeomans in Cooke, *Diseases of the Rectum and Anus*, Courtesy F. A. Davis Co.)

the remainder flowing clear. Infection of the bladder may not occur, so that a large fistulous opening of this type may be compatible with life.

Prognosis

The prognosis depends on the nature of the malformation, other associated congenital defects and the condition of the patient. When the imperforate rectum or imperforate anus has no outlet into another viscus or upon the surface, obstruction is complete, and immediate operation offers the only hope of preserving life.

If such a fistulous opening is present, symptoms of obstruction may be deferred, but the operation should not be postponed; for within a short time symptoms of fecal retention will demand surgical relief. Practically the only

exception to this rule is imperforate rectum with vulval outlet where the orifice *ab initio* is frequently adequate or may be so made and maintained by dilatation until the structures are more developed.

The direct causes of death in imperforation are distention of the bowel with feces and gas, resulting in intestinal paralysis; exhaustion from refusal of food, vomiting, toxemia and peritonitis. Although Welch found the meconium sterile at birth, it is contaminated by the third day. As these symptoms rapidly become cumulative, the patient's resistance ebbs with every hour of delay, so that the longer the operation is postponed, the graver is the prognosis. When intestinal paralysis is present, the surgeon may successfully open the bowel, but peristalsis is absent and the relief transient.

Since the advent of aseptic surgery, the operative results have shown a marked improvement. In 1879, Bodenhamer reported that "of 345 patients upon whom operations had been performed, 160 recovered," while in the author's collected series of thirty-four cases, nearly all of which were operated upon since 1897, fecal drainage was successfully established in thirty-one.

Prognosis is favorable when the defect consists in narrowing of the anal canal, when there is complete occlusion by a thin membrane, and when the rectum is normal but a fistula is present, unless the latter opens into the bladder. The prospect is unfavorable when the rectum is extrapelvic or obliterated, and when the anomaly is associated with other congenital defects not amenable to treatment.

Treatment

Embryologically there are many types of anorectal malformation, but in practice they may all be divided into two classes: Imperforations with complete obstruction, demanding immediate operative relief; imperforations with

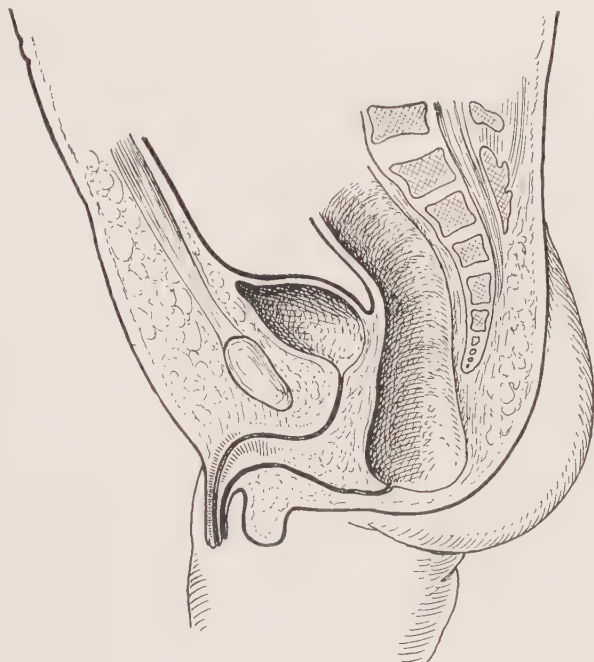


FIG. 50.—IMPERFORATE ANUS, OPENING IN PREPUCE.
(Yeomans in Cooke, *Diseases of the Rectum and Anus*, Courtesy F. A. Davis Co.)

fistulous outlets. The surgical indications are: (1) To establish fecal drainage, and (2) to supply an outlet that will, so far as possible, imitate the natural anus in position and permanent function.

Although it is impossible to determine accurately the position of the rectal culdesac without exploration, fortunately in the vast majority of cases its situation is intrapelvic. The depth of the bony pelvis from the tip of the coccyx to the sacral promontory is 6 centimeters. Bodenhamer, in 465 cases collected prior to 1879, found total absence of rectum and colon in only forty-one instances (9 per cent).

Cripps, in fifteen personal cases, failed to find the bowel only once by perineal dissection.

Prior to 1835, imperforate rectum was commonly treated by puncture with a trocar, either directly or through a skin incision. This unsurgical procedure is obsolete. When successful it leaves a fistulous fibrous passage which requires constant dilatation to prevent closure. The grave immediate danger is that the peritoneal cavity may unwittingly be traversed by the trocar and septic peritonitis result from the meconium extravasated from the punctured rectum (Fig. 51).



FIG. 51.—IMPERFORATE RECTUM.

Danger of puncturing. Arrow *A* shows course taken by a trocar through the peritoneal cavity *P*. (After Cripps. Yeomans in Cooke, *Diseases of the Rectum and Anus*, Courtesy F. A. Davis Co.)

there is strong evidence that the position of the rectal pouch is very high, proctoplasty is indicated, *i.e.*, the formation of an anus in imitation of the natural orifice. In 1835, Amussat proposed this original procedure which accords with modern surgical principles and has, with slight modification, been practiced ever since. The patient, under light ether anesthesia, is placed in the exaggerated lithotomy position. As the parts are very small, good light and retraction are essential. The steps of the operation are: (1) Median perineal incision from the scrotum or fourchet to tip of the coccyx. If an anal depression is present, the incision begins at its posterior margin. (2) Cautious division, by sharp or blunt dissection, of all tissues strictly in the midline, following the sacral curve to avoid injury of the genito-urinary organs, until the subperitoneal fat is reached, if necessary. (3) Recognition and isolation of the distended greenish rectal culdesac, bringing the sac down to the level of the skin. (4) Fixation of the bowel

Proctoplasty. — Unless

to skin or external sphincter muscle, if present, by a double row of Lembert sutures. (5) Incision of the bowel and evacuation of its contents at once if greatly distended, or after an interval of twelve hours, although delay is of little advantage as the meconium is sterile.

Obviously, when the rectum ends high, deeper dissection will be required than this simple perineal incision permits. The obstacle is the bony framework of the pelvis. In a well-developed child born at full term the distance between the ischial tuberosities is approximately 2 centimeters; from scrotum or fourchet to tip of coccyx 4 centimeters; and from tip of coccyx to sacral promontory 6 centimeters. Contracted or malformed pelvis, sometimes associated with congenital anorectal defects, may further limit the operative field. In order to gain more room for reaching the rectum in a high position the coccyx may be resected, as first done by Amussat in 1842. Another method of increasing access is to bisect the coccyx (median coccygotomy of Polallion, 1875) and, if necessary, the sacrum may be divided up to the lower border of its third vertebra (median sacrococcygotomy of Vincent, 1887). In these procedures, the supporting levatores are preserved, no essential nerves are cut, and bleeding is slight. The osteoplastic flaps are retracted and the median raphé between the levatores is divided under sight and touch. If the rectal pouch is intrapelvic, it will now usually be discovered. It is not wise to carry the dissection deeper than 5 centimeters and the pelvic peritoneum should not be opened unless the enteron is seen just above. The rectal culdesac is drawn through the wound, if possible. If the bowel is short, its contents may be evacuated, thereby elongating its canal; the gut is then sutured at the normal anal site, or at the lowest point that it will reach without undue tension in the region of the coccyx or sacrum. In any event the bowel must be brought below the level of the levator muscles to obtain their sphincteric control which may be further assured by Gersuny's procedure of axial rotation of the gut and fixation by a double row of sutures. When it is necessary to establish the anus in the coccygeal or sacral regions, the osseous tissue is removed from one of the flaps to obviate the objection to placing the anus between two bone-flaps, and an ellipse of skin is removed from each side of the wound to afford a broader area of attachment of the gut.

Proctoplasties yield excellent immediate results. In the exceptional cases with well-developed external sphincters, the remote functional results are good. Most of the others have a variable degree of incontinence and bougies must be passed regularly to maintain a patent canal and prevent cicatricial contraction.

Fitchet reports two cases of total absence of *anus*, with rectal pouch situated at about the level of the sacral promontory, in both of which he succeeded in bringing the bowel to the normal anal site through a median perineal incision. Both children developed normally, but there was no sphincteric control and bougies had to be passed regularly to prevent cicatricial contraction of the anus.

Colostomy.—Too much time should not be lost in search of the rectal pouch through the perineum. The dissection should be completed within ten

minutes, and if the pouch cannot be found and delivered through the wound, left inguinal colostomy should be performed at once (secondary colostomy). If possible, the artificial opening should always be made in the sigmoid, but if it is absent or cannot be recognized, the most distended loop of bowel that presents must be utilized. Occasionally after opening the abdomen, the rectum is found sufficiently low that it may be grasped by forceps and depressed through the pelvic peritoneum to the anal site (celiotomy and combined proctoplasty).

In 1856, Chassignac advocated colostomy preliminary to proctoplasty at the same or a later operation. Despite some reported successes, the results in general are poor. It must be admitted, however, that many of the patients subjected to colostomy are *in extremis* from intestinal obstruction or exhausted from earlier attempts to reach the bowel through the perineum. Clinical experience favors primary search for the bowel through the perineum unless physical findings strongly indicate that the rectal pouch is extrapelvic.

The comparative results of proctoplasty and colostomy are shown in the cases collected by Anders, Curling, Cripps and Tuttle.

MORTALITY FROM DIFFERENT OPERATIONS FOR IMPERFORATE ANUS

Operation	Anders Per Cent	Curling Per Cent	Cripps Per Cent	Tuttle Per Cent
Colostomy, primary	52.3	47.6	68.4	43.7 (32 cases)
Colostomy, secondary (after procto- plasty had been attempted)				45.2 (42 cases)
Proctoplasty	30.5	39.3	32.7	
Proctoplasty, omitting atresia ani vaginalis	38.2		40.4	39.3 (66 cases)
TOTAL CASES	67	100		140

Imperforate Rectum with Outlet into Bladder, Urethra, Uterus or Vagina.—Imperforate rectum or anus with a fistulous opening comprises about 40 per cent of anorectal malformations. The prognosis in cases of rectal imperforation with fistulous outlet is grave. General surgical principles are to be followed in their treatment. The first objective is to provide drainage for the bowel, second to divide the fistulous tract and invert its ends. When the rectum communicates with the bladder, early surgical intervention is essential to prevent ascending infection of the kidney. The safest measure is left inguinal colostomy. Following this procedure the fistula may close spontaneously. If it remains patent after the parts have developed, effort to close it by proctoplasty may be made and, if successful, the colostomy may be closed later.

Disposition of the Anal Infundibulum.—When the anal canal is well developed, it is usually encircled by a fairly efficient sphincter ani. Excluding simple occlusion of the anal canal by a thin diaphragm, the rectum may be anterior, but is more frequently posterior to the anal invagination, or may be

arrested at a higher level. Whatever its position, the rectum should, if possible, be implanted at the normal site and the anal sphincter utilized for its control. Methods available to effect continuity of the rectum with the developed proctodeum are: (*a*) To divide the anal canal and suture the rectal culdesac into the wound, as Matas did successfully in one case (lateral proctorectorrhaphy); (*b*) to excise the apex of the infundibulum and suture the rectum to the margin of the anal canal above the sphincter, technically difficult (circular proctorectorrhaphy); or (*c*) to "remove entirely the mucosa of the anal culdesac down to its junction with the skin by careful dissection and substitute for it the mucous membrane of the enteron" (Matas), which experience teaches to be the best and most practical procedure.

Urogenital Outlet in Rectum (Anus and Rectum Normal).—Bodenhamer collected seven cases in which the ureters terminated in the rectum, the bladder being absent in all of them. Surgery, of course, is contra-indicated, but the rectum may gain a peculiar tolerance for the urine and some patients with this anomaly have lived a considerable time without infection ascending to the kidney.

In the extraordinary cases of the uterus or vagina opening into the rectum, the orifice is usually large. Treatment presents a difficult surgical problem. Bodenhamer reported that in one instance operation was a success.

Anus Totally Absent.—In these cases the rectum may be normally developed, or absent wholly or in part. The treatment is by proctoplasty as previously described, care being taken to so place the incision that its center corresponds to the site of the normal anus.

Congenital Stenosis of Anal Canal.—Congenital narrowing of the anal canal usually first attracts attention by constipation and straining some time after birth when the feces are formed. Gradual dilatation with the finger or bougies may be effective. If, however, as the result of irritation, the canal is firm and fibrous, the stricture should be divided freely in its posterior midline, or completely excised, bringing the elevated rectal mucosa down over the raw surface and suturing it to the skin.

Occlusion of Anus.—Superficial bands are easily removed with scissors. Partial occlusion of the anal canal is amenable to thorough incision followed by dilatation. Complete occlusion by a thin membrane at the apex of the anal canal is a rare occurrence. Treatment is by a crucial incision of the membrane, the skin tabs atrophying later, but, if dense, they should be ablated. Failure of the meconium to flow at once should arouse suspicion that the peritoneal culdesac, interposed between the anus and rectum, has been accidentally opened, or that the rectum is occluded by septa or agglutination of its mucosa.

Imperforate Anus with Vulval, Perineal, Scrotal, Suburethral or Anterior Urethral Outlet.—A short duct, opening, for example, in the perineum, should be dissected out with the rectal culdesac, and fecal outlet established at the site of the normal anus. In the case of long fistulous tracts, such as those

ending in the prepuce or scrotum, the rectum is mobilized and drawn down; the tract cut across, its divided ends inverted and sutured. The narrow distal portion of the tract thus isolated has a natural tendency to atrophy. If its persistence becomes troublesome, it may later be removed.

Imperforate anus with vulval outlet is of great practical interest as it is the commonest type of anorectal imperforation with a fistulous opening, and



FIG. 52.—ATRESIA ANI VAGINALIS.

Imperforate depression at normal anal site. Girl baby eight days old. Rectum and sigmoid injected with barium. (Courtesy of H. M. Jaffe.)

the results of treatment are favorable both as to life and function. Cripps reported fourteen recoveries in fifteen cases. The opening varies in size. Usually the outlet into the fourchet is of sufficient size to drain the bowel; if too small for function, the orifice should be dilated with bougies until the parts have developed sufficiently for operation. When the opening is large or fecal stasis can be averted by dilatation, attempt at radical cure by proctoplasty should be deferred until the child is five or preferably nine or ten years of age. Then the parts are better developed and operation is borne well.

Modern surgical treatment of this condition dates from 1869, when Rizzoli

reported four cases with complete success by a new method. He pointed out that in cases where the vulval anus is relatively competent the orifice must be surrounded by some sphincteric muscle which must be preserved and utilized.

Operative Procedure.—An incision around and slightly distant from the labial orifice is extended backward in the midline to the coccyx; careful median division of the levator ani muscles; separation by perineal dissection of rectum with vulval outlet intact from vagina until it can be displaced, without undue tension, into the posterior angle of the wound, where the margin of the anus is sutured to the skin; closure of the perineal wound by suturing the

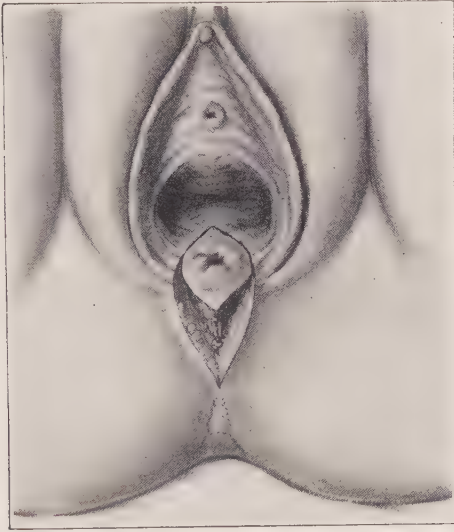


FIG. 53.—ATRESIA ANI VAGINALIS.

First step: Incision around the opening in the fourchet, extended back to the coccyx.

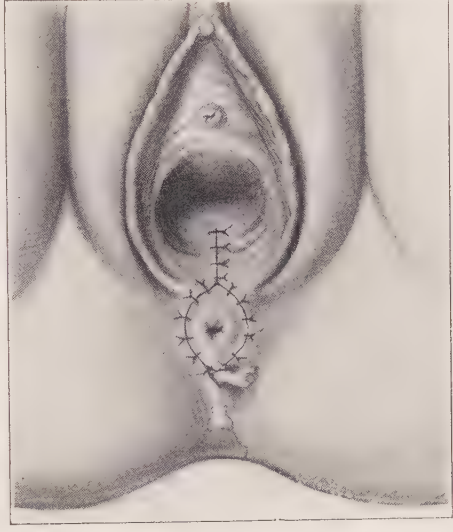


FIG. 54.—ATRESIA ANI VAGINALIS.

Terminal bowel, dissected free, is displaced backward to the coccyx, where it is sutured to the skin, and anterior portion of wound is closed.

divided levatores ani anterior to the rectum, and coaptation of the margins of the vaginal opening and the perineal skin by superficial sutures. The orifice is placed somewhat posterior to the normal anal site to overcome the tendency of cicatricial contraction to draw it forward. The merits of this operation are the formation of a strong perineal body, and a septum which completely and permanently separates the rectum from the vagina. In some instances the anal outlet is competent, but in others control of feces is poor. If the orifice is too small, dilatation or posterior incision may become necessary.

The writer has tabulated at the end of this chapter forty-one cases of anorectal deformities, all of which occurred in New York City within the period of aseptic surgery. Including most of these in a summary of sixty-one cases, Brenner compiled the table on page 64.

SERIES OF CASES COLLECTED BY THE AUTHOR IN NEW YORK CITY HOSPITALS

IMPERFORATE RECTUM

No.	Hospital	Date	Sex		Age at Operation	Condition	Other Abnormalities	Operation	Anesthetic	Result		Remarks, Complications
			Male	Female						Immediate Relief	Remote	
1.	Bellevue, Dr. Lusk	Aug. 9th, 1908	X	...	1 day	One of twins	Anus absent	Perineal	Cocain	Relief	Sept. 16th, 1909, O. K. with dilatation	None
2.	Bellevue, Dr. Hartwell	Nov. 3rd, 1910	X	...	3 days	Vomiting, distention	Anus absent	Colostomy (secondary)	None	Relief	Not stated	None
3.	Bellevue, Dr. Bryant	Dec. 31st, 1907	X	...	3 days	Distention	Anus absent	Perineal	Cocain	Relief	Died, 48 hours	Intestinal obstruction
4.	Manhattan Maternity, No. 3638	July 20th, 1912	...	...	1 day	Poor	Anus absent	Colostomy (secondary)	.....	Relief	Died, 16 days	Marasmus
5.	Manhattan Maternity, No. 2253	Sept. 25th, 1910	...	...	2 days	Poor, intestinal obstruction	Congenital stenosis. Ascending colon (autopsy)	None	.....	.....	Died, 2 days old	
6.	Lying-In, No. 777, Dr. A. B. Davis	Dec. 5th, 1908	X	...	1 day	.....	.....	Colostomy	.....	Died		
7.	Lying-In, No. 7123, Dr. A. B. Davis	Feb. 27th, 1906	...	X	4 days	Distention, jaundice	Anus absent	Colostomy (secondary)	Chloroform	Relief	Died, 5 weeks	Marasmus
8.	Lying-In, No. 14539	Jan. 27th, 1909	X	...	8 days	Premature	Fibrous cord from anus to ascending colon. Rectum and remainder of colon absent	Enterostomy	Chloroform	Relief	Died, few hours	
9.	N. Y. H., No. 3976, Dr. Stimson	Dec. 23rd, 1898	X	...	2 days	Distention, vomiting	None	None	.....	.....	Died	Intestinal obstruction
10.	Lying-In, No. 802, Dr. A. B. Davis	Oct. 10th, 1909	X	...	1 day	Distention, vomiting	None	Perineal	Ether	Relief	Died, 4th day	Postoperative hemorrhage
11.	Lying-In, No. 1160, Dr. A. B. Davis	Jan. 3rd, 1912	X	...	1 day	Icterus neonatorum	None	Perineal	Chloroform	Relief	Died, 16 days	Intestinal obstruction
12.	Lying-In, No. 1712	July 21st, 1910	X	...	1 day	Vigorous	Anus absent	Perineal	Chloroform	Relief	Good	

SERIES OF CASES COLLECTED BY THE AUTHOR IN NEW YORK CITY HOSPITALS—Continued

IMPERFORATE RECTUM, URETHRAL OUTLET

No.	Hospital	Date	Age at Operation		Condition	Other Abnormalities	Operation	Anesthetic	Result		Remarks, Complications
			Male	Female					Immediate	Remote	
13.	N. Y. H., No. 28167, Dr. F. Markoe	Nov. 28th, 1904	...	X	3 days	Distention, marked	Anus absent	Perineal. 24 hours later, colostomy (secondary)	None	No relief	Died, few hours Shock
14.	Lying-In, No. 536, Dr. C. B. Knapp	Feb. 23rd, 1907	X	...	2 days	Dribbling urine and meconium from urethra	None	Colostomy (secondary)	.....	Relief slight	Died, 4 days Peritonitis

IMPERFORATE RECTUM, VAGINAL OUTLET

No.	Hospital	Date	Age at Operation		Condition	Other Abnormalities	Operation	Anesthetic	Result		Remarks, Complications
			Male	Female					Immediate	Remote	
15.	Lying-In, No. 747, Dr. A. B. Davis	Oct. 5th, 1908	...	X	1 day	Fair, 5 pounds	Spina bifida. Doubletalipes equino. Congenital syphilis	Perineal	Ether	Relief	Died, 3 days Marasmus at Opening at center of posterior wall of vagina
16.	Babies', No. 710	Sept. 28th, 1907	...	X	19 days	Fair, 7 $\frac{7}{16}$ pounds	Anus absent	Perineal	.....	Relief	Fistula in upper part of vagina not treated

SERIES OF CASES COLLECTED BY THE AUTHOR IN NEW YORK CITY HOSPITALS—*Continued*

IMPERFORATE ANUS

No.	Hospital	Date	Male	Female	Age at Operation	Condition	Other Abnormalities	Operation	Anesthetic	Result		Remarks, Complications
										Immediate	Remote	
17.	Lying-In, No. 20, Dr. Carmalt	Aug. 13th, 1908	X	...	2 days	One of twins, 5 $\frac{7}{16}$ pounds, Frail, disten- tion	None	Perineal	Chloro- form	Relief	Good, 2 weeks later	Not traced
18.	Lying-In, No. 481, Dr. J. Markoe	Nov. 1st, 1906	X	...	1 day	.....	None	Perineal	Chloro- form	Relief	Good	Not traced
19.	Lying-In, No. 164, Dr. F. Davis	Aug. 20th, 1904	...	X	.....	.....	None	Colostomy	.....	Relief	Good	
20.	Lying-In, No. 23, Dr. F. Markoe	Nov. 8th, 1898	X	...	1 day	8 pounds	None	Perineal	.....	Relief	Good	43 days later, anus O. K. General con- dition, fair. Weight, 7 pounds
21.	Lying-In, No. 922	Nov. 10th, 1909	X	...	3 days, Disten- tion	.....	None	Perineal	.....	Relief	Died, one month	Intestinal sta- sis
22.	St. Mary's, 6159, Dr. Dowd	Nov. 20th, 1909	X	...	3 days	Vomiting	None	Perineal	Ether	Relief	Good, April, 1913	
23.	St. Mary's, 2774, Dr. Dowd	July 16th, 1906	...	X	2 days	Distention	None	Perineal	.....	Relief	Good	Not traced
24.	Babies', No. 3887, Dr. Downes	July 26th, 1910	X	...	1 $\frac{1}{2}$ days	Distention, vomiting	None	Perineal	None	Relief	Good	
25.	Babies', No. 4281	Oct., 1910	X	...	16 days	Distention, vomiting	2 thumbs, right hand	Perineal when 24 hours old at another hospital	.....	.....	Good	Relieved by non-surgical treatment
26.	Bellevue, Dr. Hotchkiss	Mch. 14th, 1910	X	...	2 mos.	8 $\frac{7}{16}$ pounds, slight disten- tion, imperfo- ration incised by accoucheur at birth	None	Perineal, con- striction in- cised	.....	Relief	Good, died 10 days later	Diphtheria

SERIES OF CASES COLLECTED BY THE AUTHOR IN NEW YORK CITY HOSPITALS—Continued

IMPERFORATE ANUS (Concluded)

No.	Hospital	Date	Age at Operation		Condition	Other Abnormalities	Operation	Anesthetic	Result		Remarks, Complications
			Male	Female					Immediate	Remote	
27.	Bellevue, Dr. Vosburgh	Sept. 22nd, 1910	X	...	9 mos.	Distention. Imperforation incised at birth by accoucheur	None	Perineal	.....	Relief Good	
28.	Lying-In, No. 22761	Aug. 12th, 1912	...	X	New-born	.....	None	Perineal	.....	Relief Good	
29.	N. Y. H., No. 2815, Dr. Bull	Sept. 13th, 1884	X	...	.....	.....	None	Perineal	.....	Relief Good, April 3, 1885	
30.	Lying-In, No. 15968	Aug. 13th, 1909	N	...	2 days	Distention	None	Perineal	.....	Relief Good	

IMPERFORATE ANUS, PERINEAL OUTLET

No.	Hospital	Date	Age at Operation		Condition	Other Abnormalities	Operation	Anesthetic	Result		Remarks, Complications
			Male	Female					Immediate	Remote	
31.	N. Y. H., No. 24823	Jan. 25th, 1903	...	X	2½ mos.	Good. Anus developed. Post-anal outlet	None	Refused			
32.	Bellevue, Dr. J. B. Walker	Nov. 21st, 1908	X	...	2 days	Fistula 2 cm. long in perineum	None	Fistula opened	.....	Relief	

SERIES OF CASES COLLECTED BY THE AUTHOR IN NEW YORK CITY HOSPITALS—Continued

IMPERFORATE ANUS, SCROTAL OUTLET

No.	Hospital	Date	Age at Operation		Condition	Other Abnormalities	Operation	Anesthetic	Result		Remarks, Complications
			Male	Female					Immediate	Remote	
33.	Lying-In, No. 420, Dr. Lobenstine	July 26th, 1906	X	...	Vomiting	None	Fistula incised on director	.....	Relief		
34.	Private communication, Dr. W. C. Lusk	Feb. 27th, 1907	X	...	.....	None	Perineal. (Fistula not treated)	None	Relief	Died, few months later	

IMPERFORATE ANUS, VULVAR OUTLET

No.	Hospital	Date	Age at Operation		Condition	Other Abnormalities	Operation	Anesthetic	Result		Remarks, Complications
			Male	Female					Immediate	Remote	
35.	Babies', No. 822	Nov. 11th, 1907	...	X	Distention Opening admits catheter. Discharges freely	3 nates and 2 folds. Coccyx to right of midline	Postponed till better developed	.....	.....	.....	Readmitted Dec. 2nd, 1907, with marasmus. Died, Jan. 2nd, 1908
36.	Lying-In, No. 13	Apr. 22nd, 1897	...	X	Vulvar opening in rectum admits 9 F. catheter	None	Postponed till better developed	.....	.....	Died, July 7th, 1897	Diarrhea
37.	Bellevue, Dr. Bryant	Jan. 7th, 1905	...	X	Feces pass through vulvar opening	None	Postponed till better developed	.....	.....
38.	N. Y. H., No. 38655, Dr. A. B. Johnson	Oct. 7th, 1909	...	X	.....	.....	Perineal. (Fistula not treated)	.....	Good		

SERIES OF CASES COLLECTED BY THE AUTHOR IN NEW YORK CITY HOSPITALS—Continued

OCCLUSION OF ANUS (COMPLETE)

No.	Hospital	Date	Age at Operation		Condition	Other Abnormalities	Operation	Anesthetic	Result		Remarks, Complications
			Male	Female					Immediate	Remote	
39.	N. Y. H., Dr. Weir	Dec. 12th, 1885	X	...	Anus fully developed	.....	Incision	.....	Relief	.....	Discharged improved
40.	N. Y. H., No. 36118, Dr. Bolton	Aug. 18th, 1908	X	...	Jaundice, distention, vomiting, anus developed	None	Posterior procototomy	None	Relief	.....	Discharged improved
41.	Babies', No. 6316	June 8th, 1912	...	X	Premature. Anus developed	Malformation of heart. Atresia, pylorus and duodenum	None	.....	.....	.....	Died on day of birth (Autopsy.)

SUMMARY

Variety	Cases	Male	Female	Sex Not Stated	Operated	Successful	Died Postoperative		Unoperated
							7 within 16 days	2 within 4 days	
Imperforate rectum	12	9	1	2	10	9	.....	.....	2
Imperforate rectum, urethral outlet	2	1	1	.....	2	1	.....	.....	.....
Imperforate rectum, vaginal outlet	2	.....	2	.....	2	2	.....	.....	.....
Imperforate anus	14	11	3	.....	14	13	.....	.....	.....
Imperforate anus, vulvar outlet	4	.....	4	.....	1	1	.....	.....	3 (2 died)
Imperforate anus; perineal outlet	2	1	1	.....	1	1	.....	.....	1
Imperforate anus, scrotal outlet	2	2	.....	.....	2	2	.....	.....	1
Occlusion of anus	3	2	1	.....	2	2	.....	.....	.....
TOTALS	41	26	13	2	34	31	.....	.....	7

TYPES OF OPERATION AND MORTALITY

Operation	Cases	Successful	Causes of Deaths		Surgical Mortality, Per Cent
			Surgical	Non-Surgical	
Perineoplasty (mostly proctoplasties)	29	19	6	4	24
Inguinal colostomy	11	2	4	5	66.6
Perineal dissection for fistulous openings	10	0	0	1	0
Celiotomy and proctoplasty	2	1	1	0	50
TOTALS	52	31	11	10	26.2

REFERENCES

- AMUSSAT, J. Z. "Proctoplasty," *Gaz. méd. de Par.*, Nov. 28, 1835.
 BALL, C. B. *The Rectum, Its Diseases and Developmental Defects*, London, 1908.
 BODENHAMER, Wm. *Congenital Malformations of the Rectum and Anus*, S. S. and Wm. Wood, New York, 1860.
 BRENNER, E. C. *Surg., Gynec. & Obst.*, Chicago, May, 1915.
 CRIPPS, Harrison. *Diseases of the Rectum and Anus*, London, 1907.
 FITCHET, S. M. *Boston M. & S. J.*, July 1, 1926, Vol. 195.
 HINCKLE, Wm. A. *J. Am. M. Ass.*, Feb. 11, 1928, Vol. 90.
 KOLLMAN, J. *Handatlas der Entwicklungsgeschichte des Menschen*, Jena, 1907, Vol. II.
 MACKENZIE, F. S. *J. Anat. & Physiol.*, Lond., 1906, Vol. 40.
 MATAS, Rudolph. *Cyclopedia of Diseases of Children*, Philadelphia, 1899, Vol. V.
 RIZZOLI, Francesco. *Surgical Memoirs*, Bologna, 1869, Vol. II.
 STIEDA, Alexander. *Arch. für klin. Chir.*, Berl., 1903, Vol. 70.
 TUTTLE, James P. *Diseases of the Anus, Rectum and Pelvic Colon*, New York, D. Appleton & Co., 1902.
 YEOMANS, F. C. In *Cooke's Diseases of the Rectum and Anus*, Philadelphia, F. A. Davis Co., 1914.

CHAPTER III

DIAGNOSTIC METHODS AND PREPARATION OF PATIENT FOR OPERATION

HISTORY

General Considerations.—Osler states that “no man can be trusted to make a medical diagnosis who cannot interpret a rectal palpation.” To this I may add that diagnoses as a rule are more often missed from failure to employ, as a routine measure, the tried and reliable methods of examination than from a lack of knowledge.

Early diagnosis is imperative in affections of the rectum and colon, for many conditions of these organs, at first simple and easily corrected with proper treatment, soon become serious if neglected, entailing prolonged disability and suffering, even menacing life itself. For example, a neglected fissure may end in a fistula, or an adenoma become an inoperable carcinoma.

The patient usually volunteers the diagnosis of “piles” which the physician too often accepts and, without making a physical examination, prescribes an ointment, thereby rendering himself no less culpable than one who treats a patient with a cough without examining the chest. Fear of pain and false modesty on the part of the patient and lack of tact and perseverance by the physician often prevent him from making the local examination, without which no reliable diagnosis can be made or suitable treatment employed. In many of the best hospitals and clinics, the proctologic findings are now considered of such value in the general diagnosis, that rectal examination has become a routine measure in practically all cases. Not until this routine is adopted by the profession as a whole will diseases of the distal bowel, especially cancer, be diagnosed early and correctly.

History Taking.—As in all diseased states a complete history should be taken and recorded on a form with general mnemonic headings. The history is important but suggestive only and not to be relied upon wholly for a diagnosis. It may be termed the subjective part of the examination and has the advantage of placing the patient at ease and establishing his confidence before the physical examination and enables the physician to study the psychology of the patient and to evaluate the symptoms. A *family history* of malignant disease or tuberculosis is important, not that these are transmitted directly, but a hereditary disposition to them is significant.

The *personal history* covers occupation; places of residence, especially in the tropics; previous sickness, including typhoid fever, dysentery, and venereal

diseases; injuries, operations, habits of eating and drinking, changes of body weight and the present chief complaint. As the general practitioner is usually consulted before the specialist, he should be familiar with the symptoms referable to the distal bowel that indicate a rectal examination. These are flatulence, constipation, persistent diarrhea, constipation alternating with diarrhea, irregular bowel action, straining and protrusion at stool, abnormal discharge, pain referred to the rectum or lower abdomen, perianal itching, a feeling of weight and pressure within the pelvis or dragging over the sacrum, reflex pain, especially down the left leg, simulating sciatica, dysuria without demonstrable lesions of the urogenital organs and progressive emaciation and anemia. In young children, picking the nose, disturbed sleep and scratching the anus require a local examination.

The symptoms to be inquired into in detail are:

Pain.—Pain and bleeding are the two symptoms that, more than any other, lead the patient to seek medical relief. Owing to the abundant nerve supply of the anal canal, any lesion in this region is painful. On the other hand, because of their paucity of sensory nerves, diseases of the rectum proper and pelvic colon may progress far with only slight discomfort and no actual pain. We should ask the date and mode of onset of the pain, its location, character, intensity, duration and relation to bowel action. Ulcer or fissure of the anal canal has as its chief symptom, pain, aggravated by stool. Unless thrombosed or inflamed, hemorrhoids are not painful but often impart a sensation of fullness and warmth. Acrid diarrheal discharges cause tenesmus and a smarting of the anus. Stricture and obstructing growths in the rectum may only convey a sense of weight in the pelvis, but attempts of the bowel to empty itself may be accompanied by severe colic. Due to the intimate association of their nerve supply, the pain incident to lesions of the anal canal may reflexly be referred to other organs, *e.g.*, the uterus, prostate or, as in the classic example of Hilton, down the left leg as a spurious sciatica. Perirectal inflammation and abscesses below the pelvic diaphragm are usually very painful, while those above it may cause only slight discomfort.

Perianal itching, which is due to a degree of nerve irritation below the threshold of pain, is a frequent complaint. It is usually due to skin irritation by the discharge of a local lesion, as a fissure, but may be the local expression of a constitutional condition, as diabetes mellitus. We should elicit its location, and the time and circumstances of its occurrence. Spasm of the sphincter muscles may be closely connected with a painful lesion of the anal canal.

Hemorrhage.—This cardinal symptom always alarms the patient, and rightly so. We must ask how long bleeding has been evident; its relation to stool, or its occurrence independent of bowel function; the quantity of blood lost, and its color—bright red or dark and clotted.

Protrusion.—We must learn if the protrusion is constant or intermittent. If it occurs only at the time of defecation and is reduced spontaneously after the act or must be replaced by hand. Does it recur spontaneously or can the

patient produce it voluntarily? While extruded, does it bleed, is it painful or tender and is its consistence firm and nodular or soft and smooth? The tendency of all recurrent, chronic protrusions is to gradually weaken and relax the sphincter muscles, thus favoring extrusion. The ordinary protrusions are hemorrhoids, prolapsus ani or recti and pedunculated neoplasms.

Bowel Action.—Are the stools hard, soft or fluid? If constipated, of how long duration, and was its onset coincident with change of habits or occupation? Do cathartics or enemas relieve it? How often does the patient take purgatives? Diarrhea, continuing after the bowel is rid of all irritating material and not controlled in a few days by rational therapeutic measures, demands a rectal examination. Frequent passages do not necessarily connote true diarrhea, as the patient frequently interprets abnormal discharge, *e.g.*, mucus, pus and blood, as feces. Morning diarrhea, so-called, is the occurrence of one or more urgent passages, immediately the patient arises. It is due to an accumulation of discharge in the rectum during the night, which gravitates when the erect posture is assumed and excites the desire to defecate. It is almost invariably a sign of inflammation or ulceration of the rectum or ulceration of the pelvic colon, the nature of which must always be ascertained. A little blood-tinged mucus with flatus and little feces so expelled is one of the earliest signs of carcinoma of the distal colon or rectum. A type of bowel action diagnostically significant, but commonly overlooked, occurs in prolapse or invagination of the sigmoid into the rectum. After defecation the patient has a feeling of incomplete evacuation, a sense of weight and pressure in the pelvis and of a dragging, over the sacrum, due to the tug of the sigmoid on its mesentery. Tenesmus, or long continued, ineffectual straining at stool, indicates irritation of the rectal mucosa by discharge from ulcerations. Other causes of tenesmus are fecal impaction or a foreign body; obstruction by a stricture, or external pressure from a pelvic tumor or retroverted uterus.

Ribbon-shaped Stools.—Many patients and some writers attach considerable importance to a narrow, flattened form of the feces in the diagnosis of stricture. The two factors determining the shape of the dejecta are their consistence and the caliber of the exit. Soft feces pass ribbonlike through a normal anal canal; whereas spasm of the anal sphincters, as in fissure, or organic stricture involving the canal or the rectum immediately adjacent, determines the form and diameter of the stool. Although certain combinations of the above symptoms are almost pathognomonic of certain diseases of the lower bowel, yet many of them are common to other organs related anatomically or reflexly. Hence, the physician must keep his diagnosis in abeyance and make his examination with an unprejudiced mind.

EXAMINATION

Preparation of the Patient.—As a rule it is desirable to have the rectum and pelvic colon emptied before the examination. Personally, I usually order 1 ounce of castor oil the night before the examination. This nearly always

ensures a clean bowel and is preferable to laxatives producing fluid stools. Some prefer enemas but, when employed, they should be administered three or more



FIG. 55.—LEFT LATERAL (SIMS') POSITION.
Most commonly used for digital examination of rectum.

hours before the examination, for the residue is apt to keep filling the tube and so defeat a successful proctoscopy. On the other hand, an enema is sometimes valuable in diagnosis, especially in children, for the return flow may bring down



FIG. 56.—HIPS ELEVATED ON PILLOW.

A useful position for proctoscopy when the patient is very ill or feeble, or the joints ankylosed.

internal hemorrhoids, a pedunculated tumor or prolapsus of the bowel itself. Examination must be made immediately the enema is expelled lest the protrusion recede spontaneously from view.

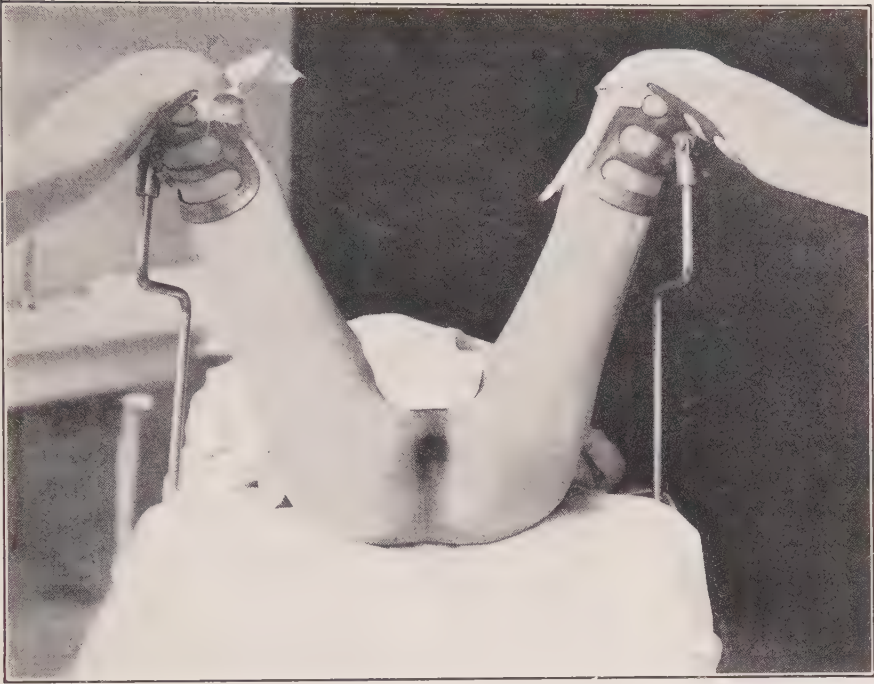


FIG. 57-A.—LITHOTOMY POSITION.

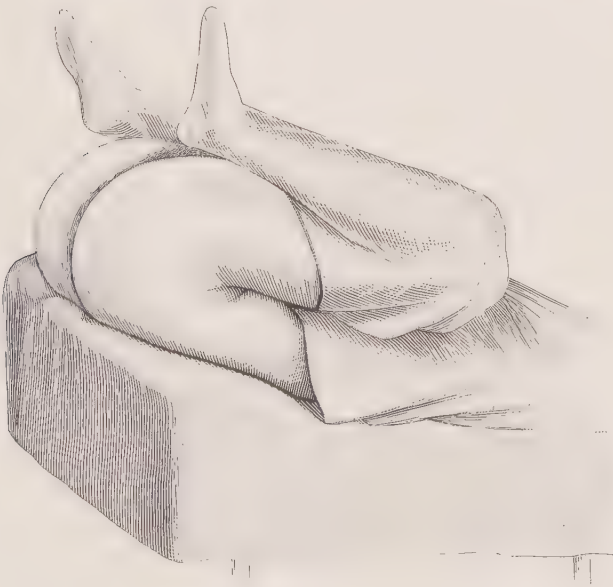


FIG. 57-B.—EXAGGERATED LITHOTOMY POSITION (Bryant).

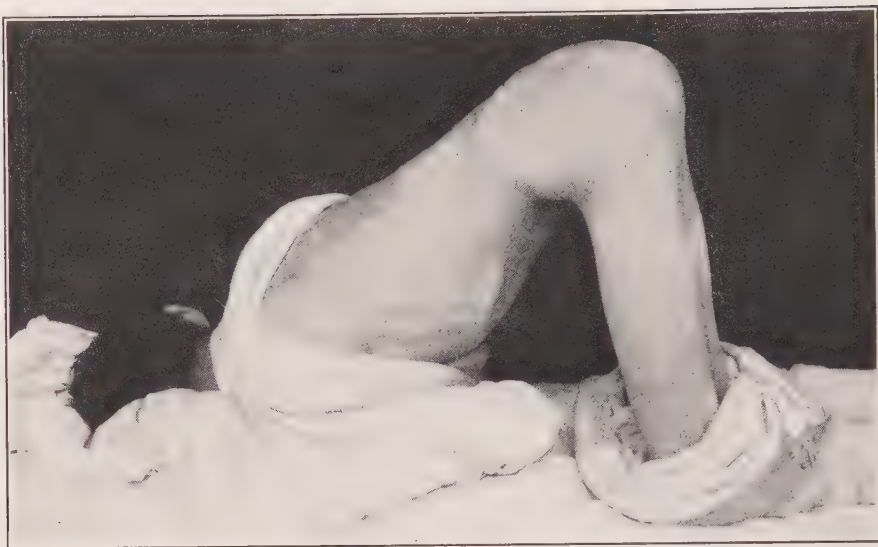


FIG. 58.—CORRECT KNEE-SHOULDER POSITION.

Shins resting on table, thighs vertical, weight on left shoulder, spine sagging and abdominal muscles relaxed.

Position.—The examination can be made on a couch or bed but whenever possible it is more satisfactory to use a firm table with an adjustable foot leaf. Special chairs and tables have been devised, but a simple examining or operating table covered with a pad serves every purpose.



FIG. 59.—KNEE-ELBOW POSITION.
Sometimes useful for examination.

Several positions are available, each of which has points of merit. The *left lateral* or Sims' position is commonly employed and with the greatest satisfaction in the majority of cases for both men and women. The hips are brought to the edge of the table and the thighs strongly flexed on the abdomen, the right thigh higher than the left, so as prominently to present the anal region (Fig. 55).

The *semiprone* Sims' position, with the hips elevated on a pillow, is of special value in instrumental examination of the upper bowel, especially in the obese and feeble (Fig. 56).

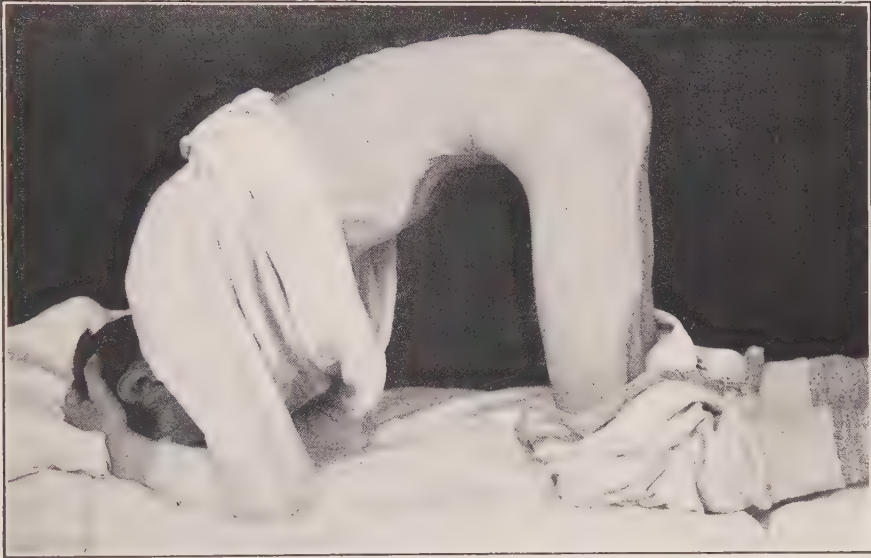


FIG. 60.—INCORRECT POSITION FOR EXAMINATION.
Note arched spine and contracted abdominal muscles.

The *lithotomy* position is used chiefly in operations, but is routine for vaginal examinations, bimanual abdominal examination, and exceptionally for performing sigmoidoscopy under general anesthesia.

With the increasing use of instruments for intrarectal inspection, the *knee-chest* position has assumed increasing importance. When correctly carried out, two desiderata are attained, namely, gravity displaces the movable viscera from the pelvis toward the diaphragm, bringing the pelvic colon more in the axis of the rectum; and atmospheric pressure distends the bowel when the anal canal is opened with a speculum. It is necessary to emphasize the word "correctly" as otherwise the patient is cramped and strained and the benefits inherent in the position are lost. The patient kneels on the foot of the table with feet projecting over its end; rests the chest and left shoulder on a pillow; faces the right with left arm across chest and right grasping edge of table. The thighs are perpen-

dicular to the table, and the spine and abdomen are relaxed. As a rule this position can be maintained without fatigue for several minutes, long enough for a satisfactory examination.

In the *inverted* position, recommended by Hanes, the body is supported on the thighs and shoulders (Fig. 61). Although this position is effective and



FIG. 61.—HANES TABLE.

Patient in inverted position and sigmoidoscope introduced.

easily assumed on the specially designed Hanes table, the author would hesitate to use it in the obese, arteriosclerotic, or those having heart lesions.

The introduction of illuminated endoscopes has largely displaced the need of the *squatting* position. The finger is introduced while the patient squats on a chair or couch and, during a straining effort, parts not otherwise palpable may be felt.

The physical examination proper is both general and local and should be carried out in a systematic way. All clothing constricting the abdomen should be removed, and, except in emergencies, the general examination should precede the local.

General Examination

The patient is weighed for comparison with his normal weight. Then the blood-pressure is taken and recorded. Pallor of the skin and conjunctiva may be due to a secondary anemia resulting from "bleeding piles" in which the hemoglobin may fall to 20 per cent. Jaundice may follow metastasis to the liver from a carcinoma of the rectum. An enlarged thyroid or cervical glands are to be noted and the mouth searched for foci of infection in the teeth or tonsils. The eye and patellar reflexes are tested. The heart and lungs are auscultated for gross lesions. A tuberculous focus in the lungs may explain the nature of a rectal fistula and an uncompensated heart lesion account for an enlarged liver.

Now, with the abdomen freely exposed, the patient stands in a good light to determine: (1) His posture, erect or drooping. (2) To what degree the abdomen is pendulous or protuberant, suggesting visceral ptosis. (3) The width of the costal angle. (4) Diastasis of the recti muscles. (5) Hernia—inguinal, femoral, ventral, umbilical and particularly epigastric, which is often overlooked. (6) Inguinal adenopathy, remembering that the lymphatics of the lower portion of the anal canal and adjacent skin drain into the inguinal glands.

Next, in the recumbent posture, the lower abdomen is carefully inspected. An abdominal tumor may be seen to move in rhythm with respiration and in thin subjects peristaltic waves of the intestine may be observed. Dilated veins in the abdominal wall near the midline, radiating from the umbilicus in the form of a so-called "caput medusæ" and whose blood current plainly flows away from the navel, point to portal obstruction due to cirrhosis of the liver or thrombosis of the portal vein.

The liver is mapped out. Cirrhosis may explain occasional copious bleeding from hemorrhoids, the safety valve of a surcharged portal circulation. Nodular hepatic enlargements may be secondary to carcinoma of the rectum or they may be gummata, while a circumscribed swelling may be an abscess from amebic dysentery. The spleen is next outlined. Splenic enlargement may interfere with colonic peristalsis. Then the kidneys are palpated, especially the right one, remembering the frequent association of movable kidney with prolapsed cecum and intestinal stasis.

The colon is now palpated systematically, beginning at the cecum. An adherent or chronically inflamed appendix with or without pericecal bands or membranes, may be responsible for cecal stasis and so intestinal toxemia, or reflexly for spastic constipation. However, experience shows that the diagnosis of chronic appendicitis should not be made without a distinct history of a previous acute attack. A tumor in the cecal region may be tuberculous, syphilitic, malignant or, particularly in infants, an intussusception; appendicular abscess, enlarged lymph glands, or merely fecal impaction. A tumor in the right upper quadrant of the abdomen may be a growth in the hepatic flexure of the colon, a diseased kidney, matted omentum or an enlarged liver. A tumor in the trans-

verse colon may be visible or palpable. A growth in the splenic flexure of the colon is usually not palpable. The left iliac fossa is next palpated. Unless the patient is very stout or the abdomen rigid, the sigmoid colon can always be felt. If it is tender or a colicky pain is produced the sigmoid is probably inflamed, while a tumor suggests a neoplasm or impaction. Intestinal diverticulitis has its most common site in the sigmoid flexure. When acute it gives characteristic symptoms of left-sided appendicitis. Indeed, in transposition of the viscera (an occurrence more frequent than is generally supposed) it can only be distinguished from left-sided appendicitis by the x-ray after a bismuth enema. Chronic diverticulitis produces a large tumorlike infiltration, and may be accompanied by the symptoms of infection—irregular fever, leukocytosis, etc. Ascites and hemorrhoids may be associated with cirrhosis of the liver, general abdominal carcinosis with a tumor in the rectum and tuberculous peritonitis with constipation.

At first, the above outline may seem tedious, but after the routine of a general examination is established all the salient points can be observed in a few minutes and in the end they richly reward the surgeon in the general estimate of his case and often elucidate the local findings.

Local Examination

For the local examination good *illumination* is essential. Daylight or light reflected from a head mirror serves well for the external examination. For inspection of the interior of the bowel nothing else is so satisfactory and reliable as a proctoscope fitted with an electric bulb.

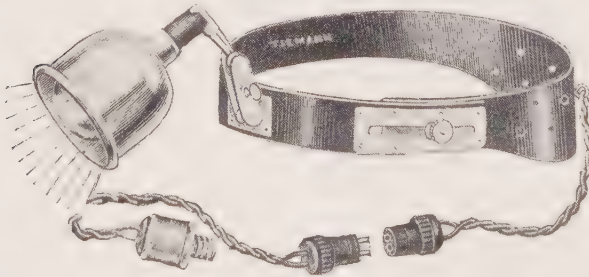


FIG. 62.—MURPHY ELECTRIC HEADLIGHT.

The patient is placed in the left lateral or Sims' position, with thighs well flexed on the abdomen.

Inspection and Palpation.—The buttocks are separated and the perianal region inspected and palpated. Loss of fat in the

ischioanal fossæ occurs early in wasting diseases, such as tuberculosis and malignancy. Any swellings are noted. If inflamed and tender they denote an abscess or a blind internal fistula. Sebaceous cysts and epithelioma also develop at the anal margin as do gummata in the ischioanal fossæ.

Loss of pigment in the perianal skin is characteristic of pruritus ani, in which the skin may be tremendously thickened and moist with hypertrophied radiating folds or thinned out and dry, readily cracking when stretched. Irritation from pediculi in adults and from pin-worms in children must be differentiated from true pruritus. Perforations of the skin are usually due to fistulæ,

which are not so often tuberculous as was formerly supposed. A word of warning is here inserted. Postanal dimple or pilonidal sinus is to be distinguished from fistula. Recalling our embryology, this mistake will not occur, for the "dimple" is due to a failure of symmetrical fusion of the ectoderm in the mid-line over the sacrum, and nothing short of a radical extirpation will effect its cure.

External hemorrhoids occur in the form of harmless but annoying skin tabs or as thrombotic piles. The latter should be incised at once and the clot turned out. Besides the gummata already noted, syphilis manifests itself here most often as condylomata, but sometimes as the primary lesion, which is usually situated in the posterior commissure. The diagnosis should be confirmed promptly and early by finding the *Spirochata pallida* in scrapings taken directly from the sore.

Systematic pressure about the anus detects areas of induration and deep tenderness. By making strong traction while the patient relaxes, the examiner observes the tone of the external sphincter. If it is relaxed, the anal canal becomes patulous.

A patent anal canal is significant and may be due to a variety of causes, as simple atony of the sphincter, lesions of the spinal cord resulting in loss of nerve control of the external sphincter, encroachment on the sphincter of a neoplasm or syphilitic ulceration, repeated dilatation of the sphincter from prolapsing internal piles or of the rectum itself, sodomy, or finally improper division of the sphincter in the operation for fistula. On the other hand, a tight, spasmodic, hypertrophied sphincter suggests irritation, usually due to ulcer or a fissure. The patient next is asked to make a straining effort, while the mucosa is gently teased out. Fissure, when present, can then be seen, usually in the posterior commissure in men, sometimes anteriorly in women, as can ulcers and pinworms in children. Uncomfortable, hypertrophied anal papillæ are protruded, as are polyps (sometimes) and internal hemorrhoids (usually). In fact this is a very satisfactory way to recognize internal piles, for contrary to most textbook teaching, they can be felt only when thrombosed, inflamed or transformed into fibrous tissue.

By the straining effort a prolapsus recti may also be protruded, but some patients require an enema to bring down the bowel. The squatting position is usually more efficient for this purpose. In children the prolapse is usually partial, *i.e.*, it consists of mucosa only, while in adults complete prolapse, involving all coats of the bowel, occurs more frequently. From the viewpoint of treatment, the diagnosis of a partial from a complete prolapse is essential but withal simple and absolute. In complete prolapse, the rugæ course circularly around the bowel, while in the partial form they radiate from its lumen as a center.

Any discharge forced out is carefully noted, indicating inflammation, ulceration, abscess or blind internal fistula. Its odor in amebic dysentery is foul, in carcinoma peculiarly fetid and diagnostic. In gonorrheal proctitis, the coccus of Neisser can usually be detected in a stained smear from the discharge.

Digital Examination.—Although a lesion has been found, we, as physicians, would be remiss in our duty to our patient, were the examination ended here, for the pathology noted may be but the external manifestation of a more serious condition within the bowel. For example, hemorrhoids may be secondary to many causes, ranging from constipation to cirrhosis of the liver, stricture or neoplasm of the rectum. I have examined many patients with carcinoma of the rectum, from whom “bleeding piles” had been removed within a few months, although the neoplasm then existed within reach of the examining finger. The early and most favorable time for the extirpation of the growth was lost through failure to make a digital examination. Such neglect is inexcusable.

Rectal palpation is the most valuable single means of recognizing and determining the nature of lesions of the last 4 or 5 inches of the bowel. It is one thing to palpate a rectum but quite another to correctly interpret the findings. Individual skill and experience alone can develop our diagnostic acumen in full measure.

The beginner should utilize every opportunity to palpate the normal rectum. Only thus can he familiarize himself with the tone of the normal anal canal, the shelving margins of the levator ani muscle above, the prostate or cervix uteri and the peritoneal pouch anteriorly, and posteriorly the sacrum and coccyx.

The greatest gentleness and tact must be exercised while examining the anus—the most sensitive segment of the alimentary tract—lest, by causing undue pain, we frustrate our efforts to complete the examination. The index finger, aptly called by Goodell “an educated probe with an eye at the end of it,” protected by a rubber tissue finger cot and lubricated with vaselin or stiff jelly, is gently insinuated through the external sphincter. We thus judge the state of this muscle—whether normal, hypertrophied and spasmodic or thin and relaxed. The pulp of the finger is carefully rotated between the sphincters, making pressure on each segment in turn for the entire circumference of the anal canal. Pressure on a fissure elicits exquisite pain, areas of induration are felt and, if very small and tender, may mean an inflamed crypt of Morgagni (often vaguely diagnosed as neuralgia of the rectum). Moreover, a small tender depression imparts the feel characteristic of the internal opening of a fistula. In the latter case, if a fistulous opening is present on the skin, and a cordlike induration is felt connecting them, the diagnosis of a complete fistula is established without resort to a probe or injection. In digital exploration of the rectum proper, it must be borne in mind that the axis of its ampulla forms nearly a right angle with the axis of the anal canal. The object usually sought is the prostate, the other possible findings being ignored. To obtain best results, the examination should be done systematically, noting, first, the bowel contents; second, lesions of the rectal wall, and, third, extrarectal structures and pathology.

The finger is now advanced into the ampulla of the rectum and determines the dryness or moisture of its surface. A relaxed voluminous mucosa indicates atony or general relaxation. If the bowel is otherwise free, constipated subjects are now requested to “bear down,” while the finger is advanced to its full

length. Often then the bowel will impinge upon and envelop the finger imparting the feel of the cervix uteri. This is really the sigmoid prolapsed into the rectum, a frequent but usually unrecognized cause of constipation of the obstructive type, particularly in infants and the aged. Its recognition is important for I have found in many cases that cathartics aggravate the condition, whereas oil enemas relieve it and in time restore the bowel to physiological action.

A sausage-like mass felt per rectum in a child with symptoms of acute intestinal obstruction is pathognomonic of intussusception. A rectal ampulla filled with feces suggests constipation of the terminal bowel or fecal impaction. Foreign bodies, including enteroliths, usually lodge within reach. Occasionally a sharp foreign body, like a fishbone, will penetrate the mucosa, causing pain, but cannot be felt till, by its irritation, induration is produced and the bone is removed by a skin incision outside the sphincter. Palpable lesions in the bowel wall itself are indurated ulcers, mural abscesses, strictures, and neoplasms; outside of it deep pelvic abscesses can be felt, as well as enlarged presacral lymphatics in children.

The cervix or retroverted fundus uteri has more than once been mistaken for a tumor of the rectum. A vaginal examination, of course, corrects this error. By exerting counterpressure above the pubes with the free hand, occasionally an intestinal growth may be brought within reach, or a large vesical stone felt, or cancer of the prostate and bladder palpated. However, to make bimanual examination advantageous, general anesthesia is usually necessary.

Blumer has recalled our attention to induration, either broad or nodular, of the peritoneal pouch, the so-called "rectal shelf," due to implantation of detached portions of carcinomata which have gravitated from tumors located elsewhere in the abdomen. There is, however, another condition which may cause a chronic induration and thickening of the pouch, palpable per rectum. This is adherent coils of intestine and omentum in tuberculous peritonitis. Scybala in the sigmoid, prolapsed in the peritoneal culdesac, may also convey the impression of a tumor.

When dealing with inflammatory conditions of the abdomen, we should never consider our examination complete without a rectal palpation. A diseased appendix lying over the pelvic brim gives decided tenderness per rectum and in neglected cases pelvic abscess ensues rather frequently—17 per cent, according to some statistics.

Stricture.—Probably 75 per cent of fibrous rectal strictures occur within the palpable zone, owing to the conditions here favoring their development. In the absence of traumata or congenital malformation, the greater number of them, in my experience, is syphilitic in origin and the feel is characteristic—firm, like a ring of cartilage, and unyielding. A positive Wassermann may confirm the diagnosis.

Neoplasms.—Of the benign rectal growths, fibromata occur in adults rather than children, are usually palpable and easily removed. Adenomata either single or multiple, sessile or pedunculated, are the benign growths occurring most fre-

quently in the intestinal tract. Their most common site is the rectum, then in order the ileum, colon, ileocecal valve and duodenum. In children, one of the most common sources of rectal bleeding is the solitary polyp which is usually small (hazelnut size) and sessile, but at times has a long pedicle implanted high. The latter allows the polyp to protrude at stool and bleed, but when the finger is introduced the tumor recedes before it. Recourse to the proctoscope must be had for its detection. Hemorrhage of this sort is often wrongly ascribed to hemorrhoids, which rarely occur in children. Two other sources of chronic bleeding in children must be thought of—one is prolapse of the rectal mucosa, the other, ulceration, secondary to chronic intussusception of the sigmoid, already mentioned.

Multiple Adenomata.—If numerous in the rectum, these can be felt, but the extent of their distribution is indicated by the proctoscope. Villous tumors are occasionally met with, but differ from adenomata only in their size and form. In the light of recent studies in pathology, the appropriate treatment of ulcers and irritation and the early removal of simple growths of every sort becomes imperative, for they are all potential cancers. Multiple adenomata are especially prone to undergo malignant change.

Malignant Growths.—Sarcoma is a rare disease of the large bowel, the mucosa does not ulcerate early and the examining finger gains the impression of a perirectal stricture rather than of a new growth. On the other hand, carcinoma in the alimentary canal occurs, next to the stomach, most frequently in the rectum, then the sigmoid flexure. The greater number are within reach, encroach upon the lumen of the bowel, are craterlike, with nodular, friable borders, bleed freely on contact and impart a characteristic, indelible impression.

When a growth is present we endeavor to determine by palpation its location, extent, movability or fixity by infiltration of adjacent organs, all weighty features from the standpoint of operative prognosis.

Plastic tuberculosis or tuberculoma of the rectum can scarcely be differentiated from carcinoma by palpation. Its tuberculous nature can usually be determined only by the microscope.

The digital examination is completed by grasping the coccyx between the examining finger within the rectum and the thumb outside to determine any variations from its normal contour, position or mobility. Particularly should one compress the soft tissue just lateral to and beyond its tip, for in coccygodynia, I have found the coccygeal plexus of nerves exquisitely tender and so established the diagnosis.

Vaginal Examination.—Due to the intimate relation of the rectum to the uterus and its appendages, the value of a vaginal examination in women is self-evident. This applies particularly to the position, size and mobility of the uterus, the contents of Douglas' pouch, and an induration, stricture or tumors of the rectum, palpable through or involving the posterior vaginal wall.

Thus, by our natural gifts of sight and touch, fortified by intelligence and experience, the majority of anorectal ailments are recognized and their nature

determined. In obscure and difficult cases, and those with lesions higher in the bowel, to confirm our tentative opinion or to reach a diagnosis, the urine must be analyzed, a complete examination of the blood, including the Wassermann reaction, must be made and instruments of precision employed. The latter are the probe, syringe, speculum, proctosigmoidoscope, microscope and x-ray.

Parenthetically, a note of caution on rectocolonic conditions secondary to diseases of the nervous system. Several years ago a competent internist requested

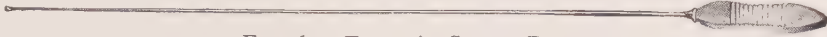


FIG. 63.—TUTTLE'S SILVER PROBE.

me to remove the hemorrhoids of a man whom he had had under observation for some time. After the operation the symptoms persisted and last year this patient developed general paresis. Some time ago a patient requested me to remove prolapsing internal piles. A relaxed sphincter excited my suspicion, his Wassermann was positive, and he showed other signs of beginning tabes dorsalis, in which operation for hemorrhoids is futile. Recently I was consulted in regard to severe and progressive constipation in a young man. His physician thought that the constipation might be of the obstructive type requiring opera-



FIG. 64.—KELLY'S ANOSCOPE.

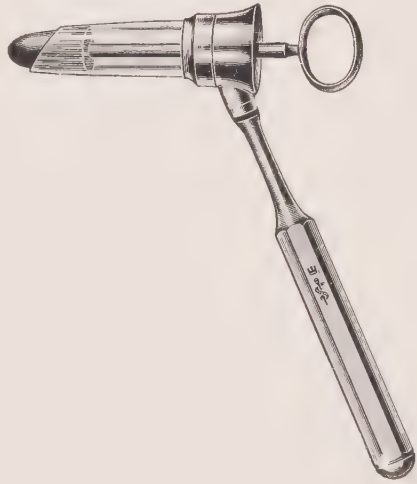


FIG. 65.—BENSAUDE'S ANOSCOPE.

tion. A neurologist's diagnosis of combined sclerosis of the cord explained the functional loss.

In conclusion, when dealing with lesions of the colon or rectum, it is imperative to exclude diseases of other organs related anatomically or reflexly, particularly of the urogenital system in males, the reproductive organs in females and of the central nervous system, before instituting treatment or operation on lesions purely secondary while overlooking their primary and causal factors.

Instrumental Examination.—The probe (Fig. 63) should have a flattened handle, corrugated on one side, and a flexible point of pure silver or block tin, that will readily follow a tortuous tract. The syringe is to inject staining fluids into fistulous tracts, to outline them and to mark the point or points of exit, as in fistulæ with multiple openings.

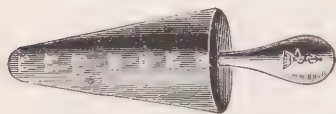


FIG. 66.—KELLY'S SPHINCTER DILATOR.

anoscope, for minute study of the anal canal; (2) proctoscope, for inspection of the interior of the rectum; (3) sigmoidoscope, for examination of the sigmoid colon; (4) bivalve dilator, for operations, and (5) Sims' vaginal speculum with reversed blades or a single blade as a rectal retractor, for examination and operations.

The anoscope of Kelly (Fig. 64) gives an excellent view of the entire anal canal by direct light or light re-



FIG. 68.—VAN BUREN'S RECTAL SPECULUM.

flected from a head mirror. After the instrument is inserted its full length, the obturator is removed and the parts inspected as the tube is withdrawn. An excellent view of internal hemorrhoids and, in fact, of the entire anal canal is thus obtained. To study the canal in detail, probe the anal crypts and the submucous or subcutaneous sinuses, the conical fenestrated speculum of Brinkerhoff (Fig. 67) is most practical. After the instrument is introduced with the sliding window closed, the slide is partly withdrawn, exposing the parts beneath. The instrument cannot be revolved without risk of injuring the tissues, so it must be withdrawn and reinserted to expose each quadrant of the canal in succession. This instrument is made in three sizes, the medium being most useful. Modifications of the Brinkerhoff have been devised by T. G. Martin, Beach, Pennington and others to make the instrument self-retaining, hinging it longitudinally (bivalve), and attaching an electric light.

The bivalve speculum, regardless of form, has no place in the examining room. It is an instrument of torture, unless the patient is under an anesthetic, traumatizes the tissues and, in practice, has been succeeded by the

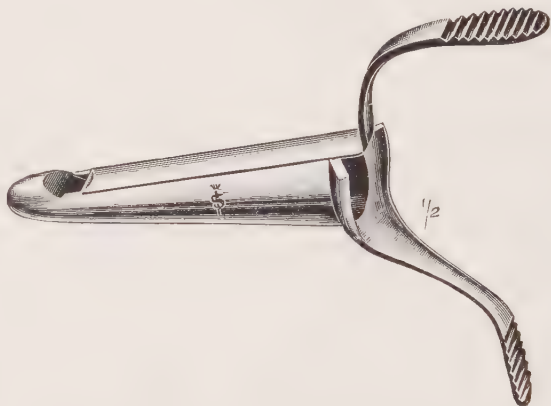


FIG. 67.—BRINKERHOFF'S RECTAL SPECULUM WITH SLIDE.

tubular speculum which can usually be used painlessly and gives a much better view. Modern proctoscopy dates from 1895 when Howard Kelly brought out a set of straight tubes of various lengths, $\frac{7}{8}$ inch in diameter, illuminated by reflected light. J. Marion Sims had long before utilized atmospheric pressure to dilate the vagina, and in 1871, Van Buren, of New York, had applied the principle to rectal examination, but Kelly's work won general recognition for the value of the method which, ever since, has been more and more used. The modern proctoscope is the Kelly tube improved and refined and supplied with

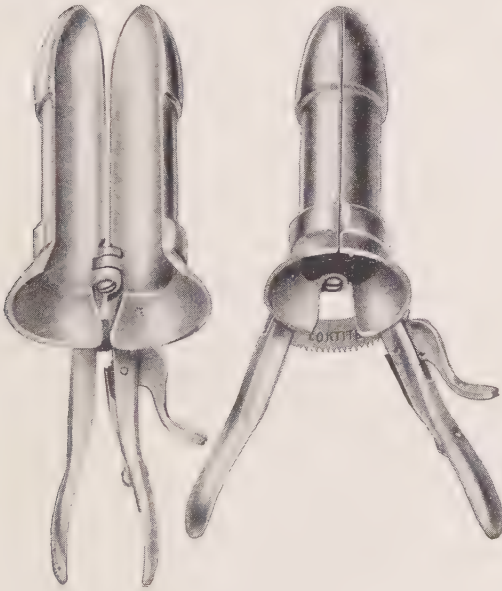


FIG. 69.—BEACH'S RECTAL SPECULUM (OPEN AND CLOSED).

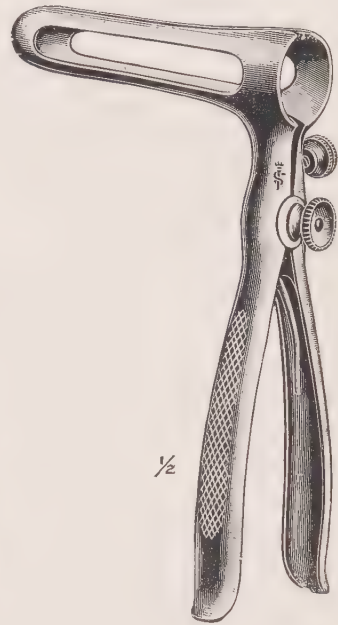


FIG. 70.—SIMS' RECTAL SPECULUM, FENESTRATED.

an electric light and an attachment for inflation of the bowel by pneumatic pressure if atmospheric pressure does not suffice, but the latter is usually sufficient. Such an instrument is styled a pneumo-electric proctoscope.

Rectoscopy and sigmoidoscopy are now firmly established as the scientific method of examining the terminal segment of the large intestine. In patients having symptoms referable to the large bowel, it is no longer a question of the value of rectoscopy and sigmoidoscopy, but of the simplest and most efficient instrument for this purpose. Before I designed my proctoscope in 1912, the majority of practical methods of direct electric illumination of the proctoscope had utilized small incandescent bulbs near the distal end of the tube on insulated carriers. The disadvantage of a distal light is that it is soiled frequently by the bowel contents and the field obscured.

Previous attempts at direct illumination of proctoscopes by a light within and at the proximal end of the tube were few and the resulting instruments complicated and unpractical.

The proctoscope of my model consists of :

(a) A tube 10 inches long and of $\frac{3}{4}$ inch diameter, graduated in inches, its distal end slightly oblique and the proximal end fitted with a large flange with



FIG. 71.—KELLY'S PROCTOSCOPE.

milled edge and a small segment cut from one side to prevent rolling. An auxiliary tube perforates the flange and joins the main tube at an angle.

(b) Illumination is direct and is obtained from a small but powerful elec-

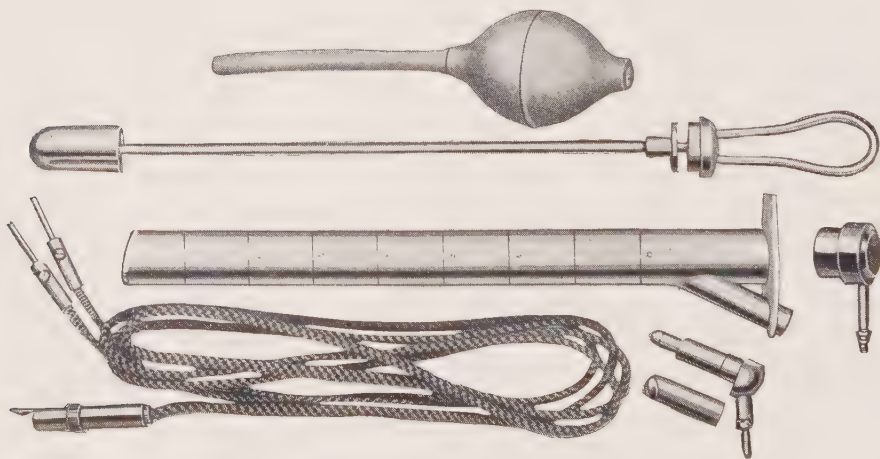


FIG. 72.—YEOMANS' PNEUMO-ELECTRIC PROCTOSCOPE.

From above downward: Inflating bulb, obturator, tube, window, connecting cord, light-carrier, lens. (Wappler E. S. I. Co.)

tric bulb which is covered with a capsule bearing a plano-convex lens so set that the collected rays are refracted at a compensating angle to the light-carrier.

The light is mounted on a carrier which fits accurately by a conical fitting into the auxiliary tube while only the lens projects into the main tube, focusing all the rays at its distal end and in no appreciable degree interfering with the vision of the observer or the introduction of instruments for examination, local applications or operation.

(c) A metallic plug closes hermetically the proximal end of the examining-tube by a conical fitting and contains a glass window which magnifies the illu-

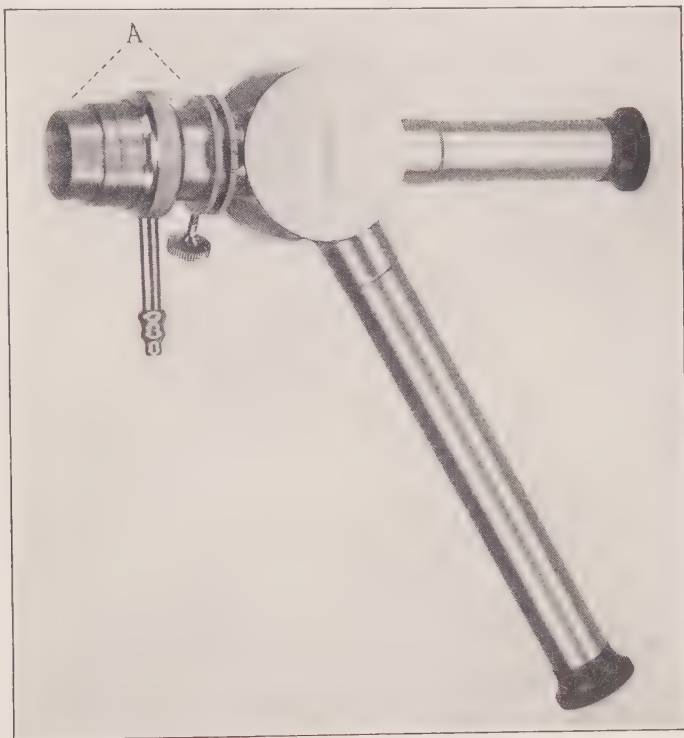


FIG. 73.—DOUBLE OBSERVATION WINDOW FOR DEMONSTRATING PROCTOSCOPIC FIELDS.
A, adapter for attachment to tube.

minated field at the distal end of the tube. The plug is perforated at the side for a small offset with a nipple for the attachment of a hand bulb to inflate the bowel to any desired extent. The conical fitting of window and light-carrier prevents escape of air when pneumatic pressure is applied and affords great facility in removing or inserting light or window.

(d) The obturator has an olivary tip which facilitates the introduction of the tube, and a broad handle so that it does not roll on a flat surface.

The tubes are of three sizes: (1) Proctoscope, 10 inches long and of $\frac{3}{4}$ inch diameter; (2) sigmoidoscope, 14 inches long and of $\frac{5}{8}$ inch diameter; (3) in-

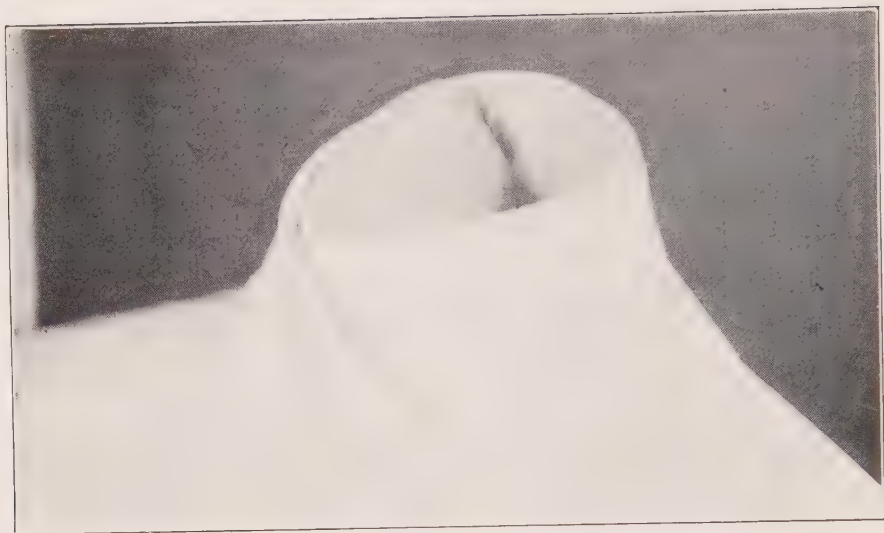


FIG. 74.—SIGMOIDOSCOPY.
Patient in knee-shoulder position, draped.

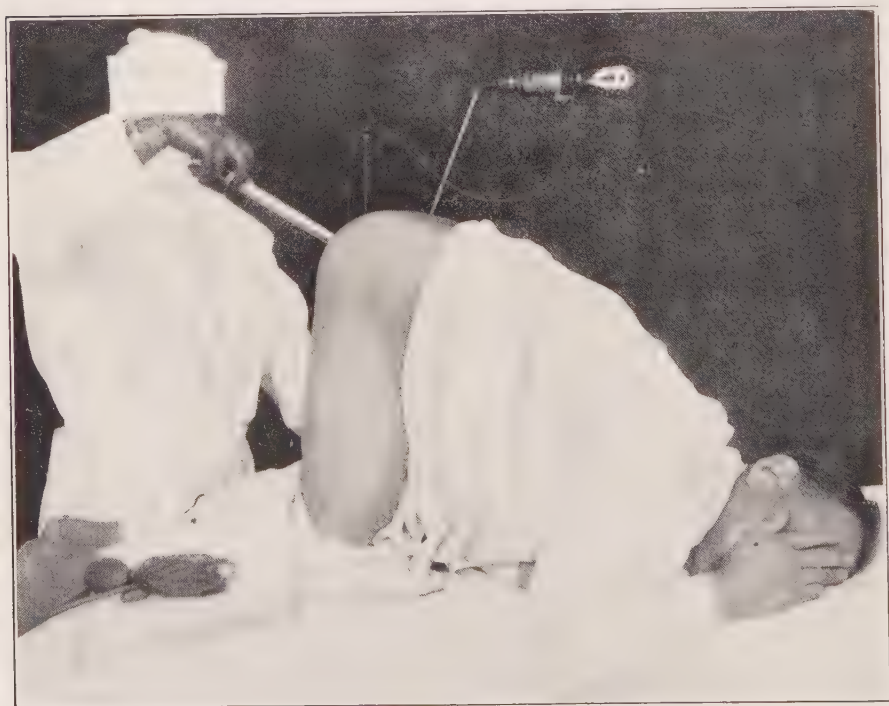


FIG. 75.—SIGMOIDOSCOPY.
First step: Introducing the sigmoidoscope through anal canal.

fant's proctoscope, 9 inches long and of $\frac{1}{2}$ inch diameter, for examining children, and adults with painful lesions of the anal canal and rectal strictures.

The same light-carrier fits all these tubes, but a smaller window is used for the infant's proctoscope. Recently I have had made on the same model an operating proctoscope 8 inches long and $1\frac{1}{4}$ inches in diameter. For the general practitioner the 10-inch proctoscope will be found most useful and will fill all requirements in the great majority of cases. The source of light may be either

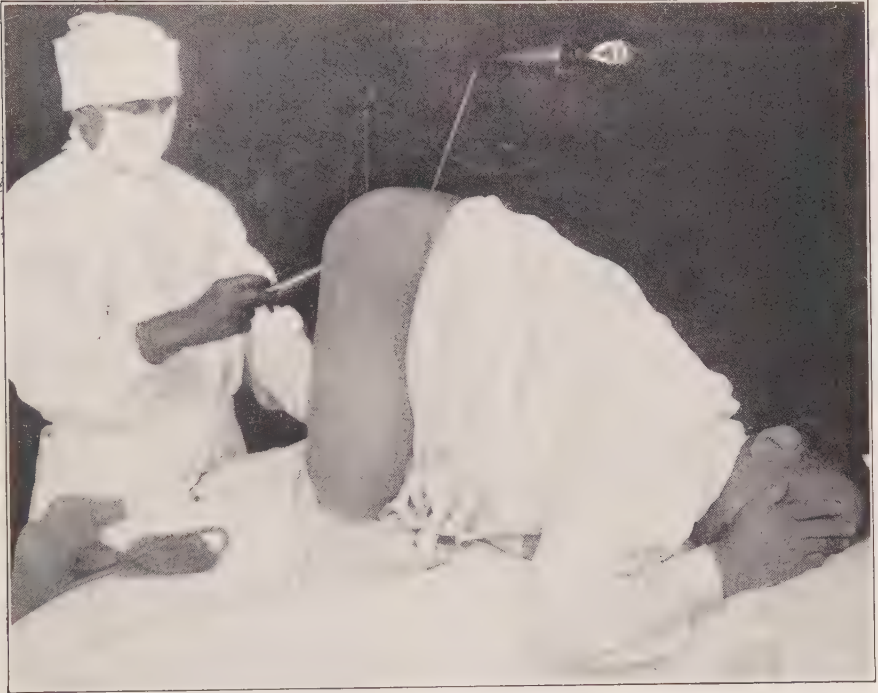


FIG. 76.—SIGMOIDOSCOPY.
Second step: Tube in rectum.

a four-cell dry battery or the street current with the usual electric controller interposed.

The features of this instrument are:

1. Simplicity.
2. The fact that the instrument is sterilizable by boiling.
3. Direct illumination by a substantial bulb which will not burn out easily.
4. The same light-carrier for all tubes.
5. Thorough practicability for the examination, diagnosis or treatment of all abnormalities occurring within the rectum or sigmoid flexure below its apex.

Technic of Proctoscopy.—Until comparatively recently, the interior of the rectum and distal sigmoid was a "terra incognita." Now, with modern endo-

scopes, every portion of the distal bowel can be accurately inspected and, in its revelations, proctoscopy is on a par with cystoscopy and ophthalmoscopy. However, as in the case of other special instruments, skill in the use of the proctoscope and experience in the interpretation of the findings are essential.

Proctoscopy is easily performed in the office and practically always without anesthesia, even in children. Unmanageable infants may require an anesthetic, but the difficulty of painful anal lesions in adults is surmounted by applying a local anesthetic and using a tube of small caliber. Except when diarrhea is pres-

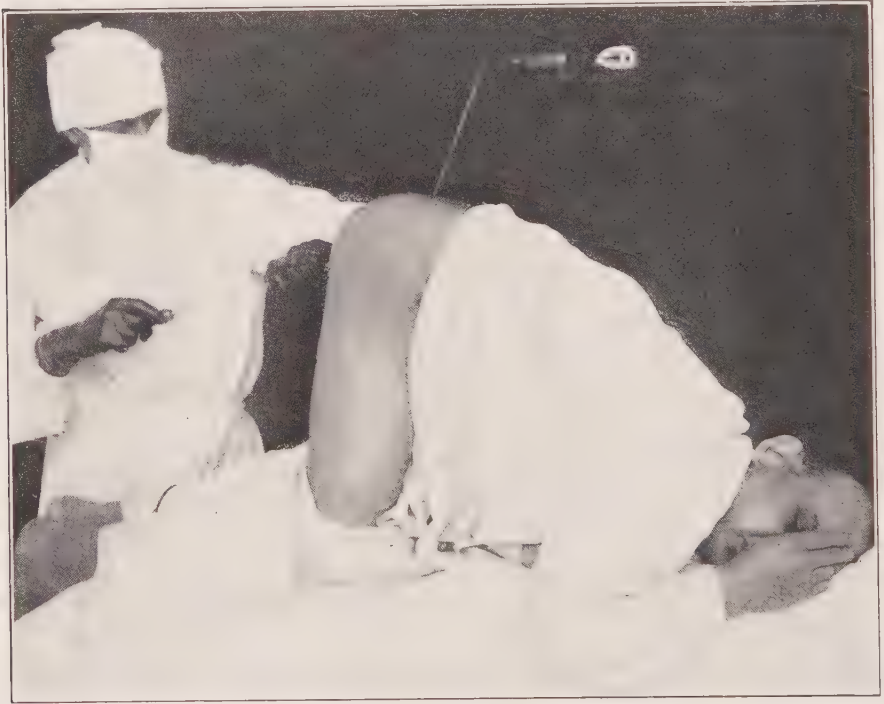


FIG. 77.—SIGMOIDOSCOPY.

Third step: Obturator withdrawn to permit atmospheric distention of bowel.

ent, the bowel should be emptied, preferably by a cathartic; the best is castor oil, taken the night before the examination, or an enema administered three or more hours in advance. When an enema is given just prior to the examination, the return flow fills the tube and obscures the pathology.

Digital examination always precedes the use of instruments. As a rule, the patient, with all constricting clothing removed, is placed in the *correct* knee-chest posture. The Sims' position with the hips elevated on a pillow is quite satisfactory and is preferable when examining very ill or feeble patients, those with cardiovascular lesions and some obese individuals, especially women. The tube with obturator in place is warmed by running warm water over its surface,

thus keeping its lumen dry, and lubricated freely with petroleum jelly or other stiff lubricant. The tube thus prepared is pressed firmly and steadily against the anus, while the patient is requested to "bear down," and passed, in the direction of the navel, a distance of 2 inches. Having thus traversed the anal canal the proximal end of the tube is elevated about 75 degrees and the tube advanced 2 inches or so into the ampulla of the rectum. The obturator is now removed and air rushes in to dilate the bowel lumen. The light is next inserted and the window attached. From this point the tube is advanced under guidance

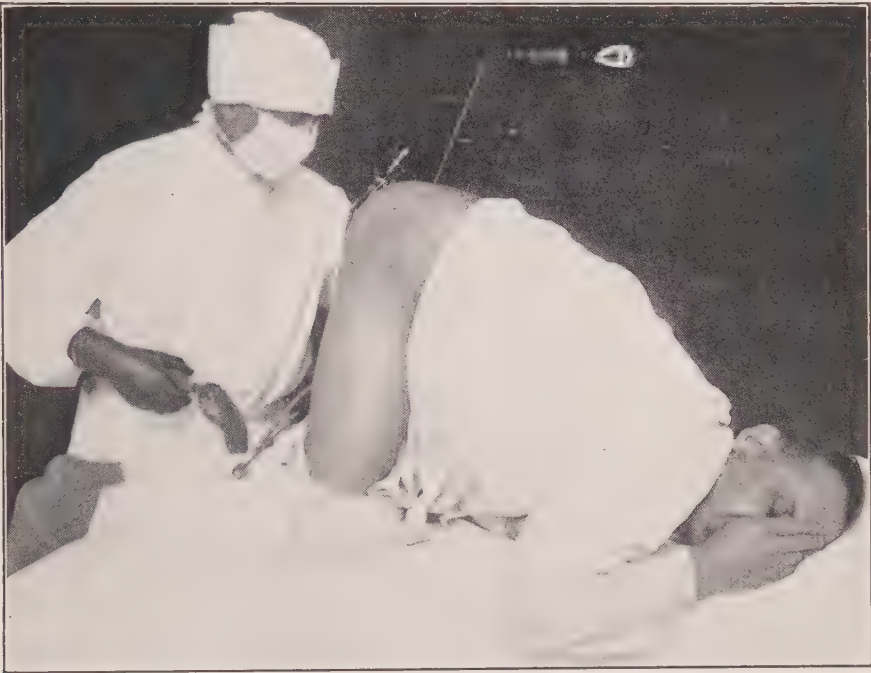


FIG. 78.—SIGMOIDOSCOPY.

Fourth step: Tube in sigmoid. Bowel being inspected.

of the eye. Its distal end should touch the mucosa only lightly and, recalling our anatomy, passed in the direction of the axis of the bowel. By manipulating its proximal end skillfully, the distal end readily pushes aside the rectal valves of Houston and reaches the rectosigmoidal juncture. The beginner may experience some difficulty in negotiating this angle. The rectum may appear to end in a culdesac about opposite the sacral promontory, but by withdrawing the tube slightly and passing it more ventrally the lumen usually comes into view. The entrance into the sigmoid is obscured by its sharp angulation with the rectum whereby a valvelike projection of the bowel wall is formed. After passing the rectosigmoidal angle, the tube is advanced into the sigmoid colon, commonly toward the left side but many times toward the right, but the mechanical limit

of its advancement is the apex of the sigmoid. This point naturally varies with the individual and is from 10 to 14 inches from the anus. In about 75 per cent of cases the tube can be passed into the sigmoid. Obstructive factors at the rectosigmoidal angle are spasm of the bowel musculature, a short mesosigmoid, adhesions of the pelvic colon, organic strictures and neoplasms. So far as possible, atmospheric pressure should be relied upon, using only slight puffs of the hand bulb when necessary. As the tube is withdrawn all parts of the mucosa are carefully inspected, including the upper portion of the anal canal, for the

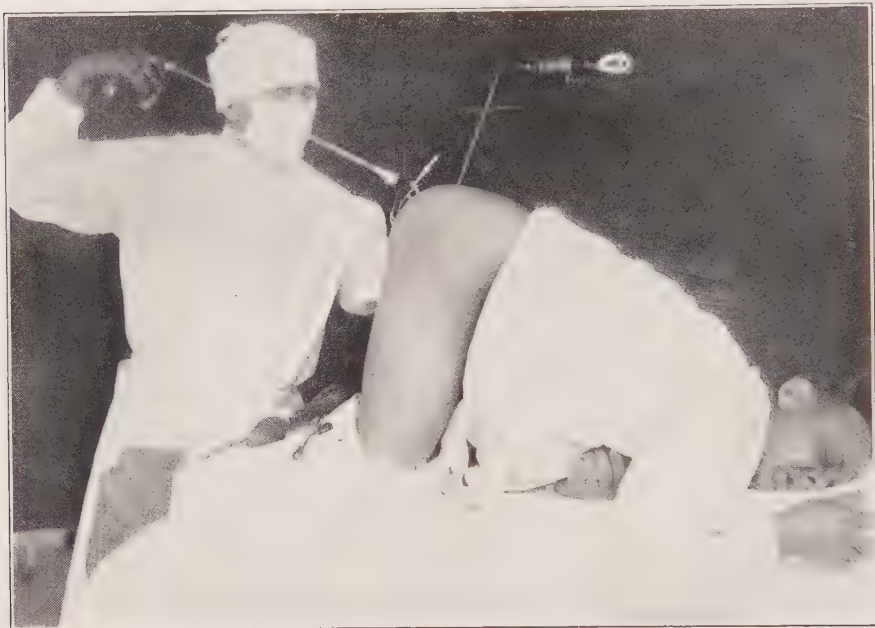


FIG. 79.—SIGMOIDOSCOPY.
Method of making topical application under direct vision.

tube demonstrates internal hemorrhoids beautifully. Just before withdrawing the tube completely the window should be removed to allow the escape of any inflated air under pressure, otherwise the patient may experience colicky pains. Employing this technic, proctosigmoidoscopy reveals at once to the experienced observer the condition of the mucosa, whether normal, atrophic or hypertrophic, as in analogous conditions in the nose. Houston's valves are readily seen and their resistance determined by a long hooked probe. The extent and character of ulcerations are disclosed and smears are taken directly from their surfaces for microscopic examination, notably for amebæ, and topical applications may be made. By a straining effort on the part of the patient, the prolapsed sigmoid is forced directly into the lumen of the tube. Benign tumors, particularly the solitary polyp with high implantation, are readily seen and may be removed by a suitable snare and the distribution of multiple adenomata noted. The tube

of small size ($\frac{1}{2}$ inch diameter) usually passes without difficulty through the lumina of strictures and malignant growths to the uninvolved area above, thus determining at once their limits—data of prime prognostic import. The small tube may also be passed successfully in cases of spasm of the anal sphincters and tender lesions of the anal canal, such as a fissure. Thus, the dangerous and unreliable olivary bougie and the torturing bivalve rectal speculum are supplanted in diagnosis.

For a proctosigmoidoscopy to be *successful*, the tube should be passed 10 or more inches. With a normal bowel or those with superficial pathology of the mucosa this is feasible, as a rule. Obstructive lesions, involving the entire bowel wall, naturally limit the excursions of the tube but at the same time the diagnosis is established.

Dangers of Proctosigmoidoscopy.—With correct technic, proctosigmoidoscopy is without danger. It is essential that the tube be passed under guidance



FIG. 80.—KELLY'S RECTAL SCOOP.

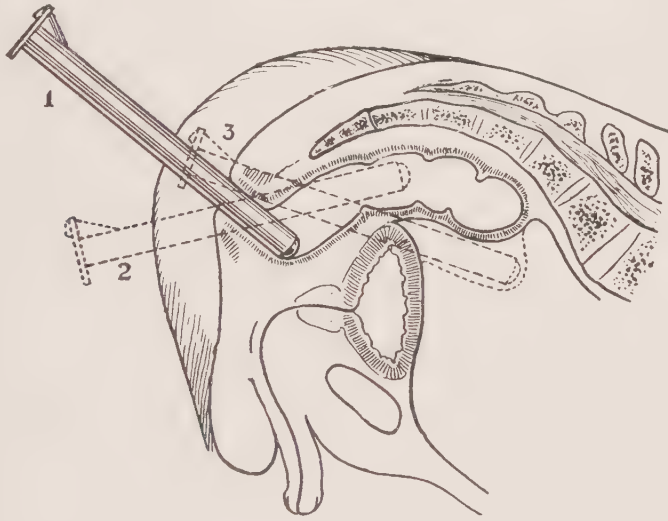


FIG. 81.—SIGMOIDOSCOPY.

Diagram showing the successive deflections of the tube through anal canal and rectum into sigmoid.

of the eye, always in the axis of the bowel, and that no force be used. Instances are on record and doubtless many others have occurred in which the gut was perforated by the tube. Naturally this is most apt to occur when the wall is very thin or rendered friable by neoplasm or other infiltration. If the site of perforation is above the peritoneal reflection, as it usually is, bowel contents escape into and infect the peritoneal cavity at once. Should this unfortunate accident

occur, the examiner should note the exact site of the perforation and its distance from the anus and with the least possible delay open the abdomen, close the bowel perforation with a double row of sutures and insert a cigarette-drain to the bottom of the peritoneal pouch. Any temporizing measures are certain to result in disaster.

Biopsy of Intestinal Tumors.—As the result of the considerable discussion of the question of probatory incision of tumors, a special committee of the

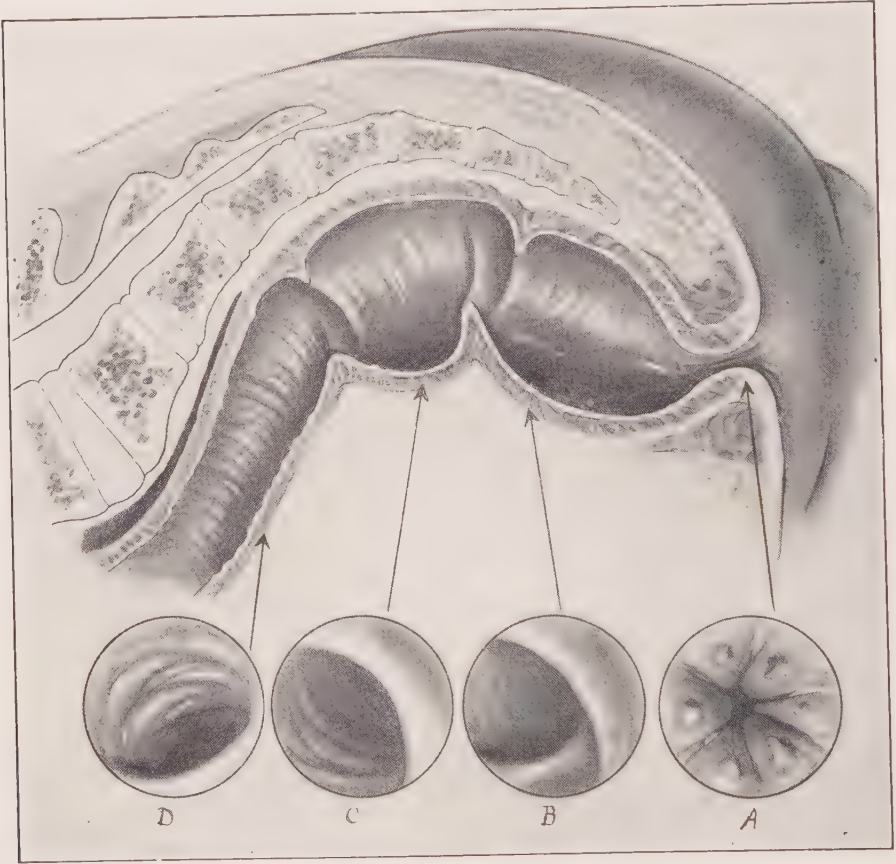


FIG. 82.—SIGMOIDOSCOPY.

Endoscopic views at various levels: *A*, anal canal, hemorrhoids and anal papillæ; *B*, Houston valves; *C*, rectosigmoid junction; *D*, sigmoid.

Society for the Control of Cancer prepared a report on the subject for the Department of Health of the City of New York, which was published in its Weekly Bulletin of March 12, 1915.

The two paramount and practical questions presented were: (*a*) The advantage of a positive diagnosis. (*b*) The danger of aggravating by trauma.

This special committee concluded that:

"It is universally agreed by surgeons and pathologists that in a large group of cases the former advantage decidedly outweighs the danger of the latter.

"It is therefore the universal practice to support the clinical by a microscopic diagnosis in cases of reasonable doubt.

"Since gross diagnosis of malignancy in tumors is difficult and sometimes impossible, it seems proper to facilitate as far as possible the means of securing accurate microscopic diagnosis.

"In general, the biopsy becomes desirable when the clinician is in doubt and a decision is urgent.

"Against these considerations stands the danger of aggravating the disease by trauma. The extent of this danger will depend on the nature and position of the tumor and must be judged in each case.

"Not a few errors in diagnosis result from incision of inflamed tissue on the edge of the tumor, the malignant area being missed. This is particularly apt to occur with inaccessible growths.

"In general, incisions into actively growing, deep-seated, malignant tumors should, if possible, be avoided. Such a trauma may disseminate tumor cells



FIG. 83.—TUTTLE'S DRESSING FORCEPS.

through the vessels and permit unnecessary extension to the skin or surrounding tissues, or accelerate growth by relief of capsular tension.

"On the other hand, there is little danger from excision by the clean cut of a sharp knife of a suitable portion of any suitable growth of skin or mucous membrane. Under all circumstances, it is highly important to avoid rough handling, kneading or crushing of tissue.

"The wisdom of biopsy may often depend on the possibility of obtaining a reliable opinion from the microscopist, in the absence of which it is better to rely on clinical judgment."

No one will gainsay the desirability of a preoperative biopsy to confirm the clinical diagnosis. This has the very practical advantage of enabling the surgeon to plan the operation in accordance with the findings. Contrast, if you will, the limited mutilation in the removal of a benign polyp of the rectum with wide excision for carcinoma.

The dangers of diagnostic incision have been justly emphasized by some authors, but in general, the writer concurs in the conclusion of the committee that there is "little danger from excision by the clean cut of a sharp knife," but that "rough handling, kneading, or crushing of tissues" are to be scrupulously avoided.

Certain lesions of the rectum within the palpable area can be diagnosed clinically with a considerable degree of accuracy. For example, an ulcerating carcinoma imparts a characteristic feel to the examining finger of the experienced

clinician. However, in the earlier stages, the examiner may be less positive and he must differentiate other conditions, as indurated ulcers, strictures, tuberculoma and benign growths. Direct inspection of these lesions through the proctoscope may clear up the diagnosis, but not always. Again, these lesions may be, and often are, located at a point beyond reach of the finger. In such cases the valuable data of direct palpation are not obtainable.

To surmount this difficulty the writer devised the biopsy forceps, here illustrated (Fig. 85), and has employed it in cases that could not be diagnosed by other methods. The forceps have been used in a large number of cases with most gratifying results, and no unfavorable consequences.

The technic is very simple. The patient assumes the knee-chest posture as for sigmoidoscopy and the sigmoidoscope is introduced. The forceps is then passed through the tube and, under direct vision, a section is "bitten out" at a point in the pathologic process most likely to yield the greatest amount of information under the microscope. In cases having an ulcerated lesion (chronic indurated ulcer, stricture, cancer or other tumor) this would be at the margin of the ulcer. In non-ulcerated tumors a specimen is taken from the neoplasm itself. Hemorrhage is slight and quickly controlled by the immediate topical application of pure phenol followed by 95 per cent alcohol, the excess being sponged away.

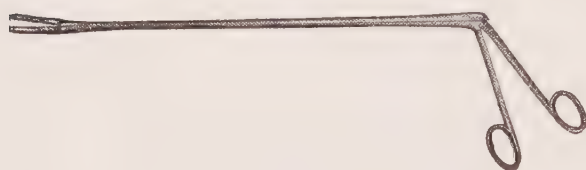


FIG. 84.—ALLIGATOR FORCEPS FOR USE THROUGH PROCTOSCOPE.
Working length, 12 inches.



FULL SIZE

FIG. 85.—YEOMANS' BIOPSY FORCEPS.

In a few instances, after operation, the question has arisen of diagnosing malignant recurrence from stenosing scar tissue at the line of the intestinal suture. Biopsy determined this point promptly and decisively.

In another class of pathologic changes, felt as tumors per rectum, biopsy is contra-indicated. This applies particularly to enlargements of the lymphatic glands of the mesorectum, especially to tuberculous adenitis in children, and to metastatic involvement of these glands by carcinoma in adults. Further, infiltration of the rectovesical pouch or culdesac of Douglas by metastases from malignant growths or tuberculous peritonitis opposes biopsy. In this category of cases, the mucosa of the rectum is usually felt to move over the surface of the tumor and not to be involved in the process. In these cases, local findings, together with the other clinical data, usually suffice for a correct diagnosis.

Biopsy through uninvolved mucous membrane leads only to an extension of a disease not suitable for or amenable to radical operation and yields no compensatory benefit to the patient.

The forceps is strong and rigid, 13 inches long, giving a working length of 2 inches distal to the end of the 10-inch sigmoidoscope of my model. The jaws have a cutting edge so that the tissue is cut out and not crushed. The specimen, retained intact on the grilled floor of the lower jaw, is 1 centimeter in width by 2 centimeters in length, which is ample for microscopic examination.

The forceps is also useful for the radical removal of small benign polyps so often present on the mucosa of the terminal colon.

Roentgenologic Examination.—Owing to the merited popularity of the x-ray examination of the gastro-intestinal tract, it has become a common practice to immediately assign, for such an examination, patients having symptoms referable to the distal colon, before employing all the ordinary diagnostic methods. We feel convinced that this is an error and that digital palpation of the rectum and proctosigmoidoscopy should always precede the x-ray examination. The finger and tube will diagnose the large majority of lesions of the rectum and distal half of the sigmoid colon far more accurately than the x-ray possibly can. Moreover, the roentgenologist should be supplied with the data thus obtained to aid him in the interpretation of his findings. Why should we seek first an uncertain shadow when we can feel or inspect the lesion itself? In a number of cases competent roentgenologists have reported to me no pathology when gross lesions were present, some of them cancer. This statement is not intended to detract from the value of the x-ray in diagnosis but, when indicated, to urge its employment in proper sequence.

After injecting them with bismuth paste, stereoscopic x-ray films are very useful in outlining tortuous tracts of fistulæ, especially those with one or more external openings located far from the anus and with an internal opening above the sphincters. To be of value in diagnoses, x-rays of the gastro-intestinal tract require a good machine, an expert technician and experienced interpretation. With these conditions, they are a most valuable asset.

To cast a shadow the bowel must contain some substance opaque to the rays. The agent commonly used is bismuth carbonate or barium sulphate suspended in fermented milk or other suitable vehicle. A complete "gastro-intestinal series" comprises the observation of the progress of an opaque meal through the tract, and, after its expulsion, observation of an opaque clysmæ. The average period of time covered is three days, but may be longer. Hurst gives the normal time for the head of the opaque column to reach the cecum as four and one-half hours; hepatic flexure, six and one-half hours; splenic flexure, nine hours; sigmoid flexure, twelve hours. These figures are subject to wide variation. Naturally the progress is slower during sleep and much faster when the bowel is inflamed. Furthermore, bismuth and barium are not food and may exert a constipating effect which slows their passage. Observations of the progress of the opaque substance are made at stated intervals. Fluoroscopy is the highest

refinement of the roentgenologist's art in intestinal diagnosis. Next in value, to best illustrate the probable lesions, are stereoscopic photographs, and finally the simple film which records those conditions found by fluoroscopic study. Fluoroscopy, after a bismuth meal, outlines the form and position of the colon, detects displacements and points of chronic intestinal obstruction (obstipation), whatever its cause; differentiates mechanical from physiological delay; locates accurately a stricture of the colon, while plates taken at intervals during two or three days reveal diverticula, if present, their most common site being the descending colon and sigmoid.

Frequently, the position and outline of the vermiform appendix are distinctly visible and simultaneous palpation determines its adherence to other structures. The appendix may be so kinked or strictured as not to admit the bismuth. On the other hand, bismuth retained several (four or five) days strongly suggests that the appendix is non-functioning because of a kink,



FIG. 86.—WALES SOFT-RUBBER RECTAL BOUGIE.

stricture or chronic inflammation, and so explains indigestion with colicky pains, irregular bowel action or constipation. Fluoroscopy during the administration of a barium enema is of prime value in showing the length and mobility of the pelvic colon, obstructions by adhesions, stricture or neoplasms, and, by its evacuation, the efficiency of the functioning of the distal colon and rectum. For this determination a film should be taken before and after evacuation of the clysma. Yet, invaluable as they are, sole reliance cannot be placed on the x-ray findings. Their correct interpretation is the crux of the question. The clinician who has had ample opportunity to compare actual conditions found at operation with roentgenologic predictions, must correlate the x-ray findings with the history, symptoms, signs and physical examination to arrive at a correct diagnosis.

Charcoal Test.—The patient takes two teaspoonfuls of charcoal with breakfast and observes the first appearance of the charcoal in the stool. The interval indicates the time of transit of the food residue through the alimentary canal. This is a simple test of value.

Bougies and Rectal Tubes in Diagnoses.—In the diagnosis of stricture, the sigmoidoscope and x-ray have supplanted the rigid and semiflexible bougie, formerly so popular. If a stricture could not be felt, arrest of the bougie gave no clear indication of what obstructed its passage. A rectal valve may arrest the instrument as well as a stricture. The soft-rubber bougie, introduced by Wales in 1883, is the only type meriting consideration. They are used chiefly in the treatment of strictures by dilation and for topical applications, but not for diagnosis. Their usual length is 12 to 14 inches and they are numbered from 1 to 12, the former being 0.8 centimeter (0.3 inch) in diameter, the latter 3 centimeters (1.2 inches). The instrument has a smooth polished surface, a small

central canal in its longitudinal axis for the injection of fluids, and a conical end which terminates in an olivary or spherical tip.

The employment of rigid bougies in the rectum is to be deprecated because of the danger of injury, rupture or perforation of the bowel wall, and even the soft-rubber Wales bougie should be used with the greatest care.



FIG. 87-A.—ROENTGENOGRAM SHOWING RUBBER TUBE, AS ORDINARILY INTRODUCED, COILED IN THE RECTUM.

The ordinary *rectal tube*, as usually employed for the administration of a so-called high enema, in the majority of cases coils up in the ampulla of the rectum, as can be demonstrated by digital examination or by the x-ray (Fig. 87-A). The only certain way of introducing it into the sigmoid colon is to pass it through a tubular speculum *in situ* (Fig. 87-B).

Examination under General Anesthesia.—Modern methods of examination have practically eliminated the need of general anesthesia in the diagnosis of diseases of the rectum and pelvic colon. It has the great disadvantage of doing away with the sensation of the patient, an important aid in the diagnosis,

which should be fully utilized in the examination. However, certain hyperesthetic patients with very painful lesions may require a general anesthetic. In these, the nature of the lesion is usually evident, as an abscess or infected



FIG. 87-B.—ROENTGENOGRAM OF SIGMOIDOSCOPE IN SITU.
Rubber tube passed through tube and through proximal loop of sigmoid.

fissure, and the surgeon should be prepared to carry out the necessary surgical procedure immediately the precise diagnosis is made after the induction of anesthesia.

Laboratory Examinations

For the technic of the methods of examination and of testing the fluids and excretions of the body, the reader should consult standard textbooks on clinical pathology.

Urine.—Routine urinalysis should be done, for it not only shows the kidney function in part but may shed valuable light on the diagnosis and method of

treatment. Glycosuria may explain a pruritus, and acetone-bodies are suggestive of a lowering of the alkali reserve. Indican in excess in the urine is generally understood to indicate protein putrefaction, especially in the colon. In stasis toxemia and in catarrhal and ulcerative colitis indicanuria is quite regularly present. Some products of albuminous decomposition when absorbed may produce toxic symptoms.

Before undertaking a major operation, a phenolsulphonephthalein test should be made to determine the kidney function. Any tendency to acidosis may be counteracted by the administration of alkalies; and, in the case of diabetics, by increasing carbohydrate tolerance by the use of insulin. The choice of an anesthetic is governed in many cases by the urinalysis, supplemented, when necessary, by chemistry of the blood.

In all cases of tumor, stricture or ulceration of the rectum or colon, a Wassermann test of the blood should be made for syphilis, as it may be significant in the differential diagnosis. In certain cases, chemistry of the blood is very valuable. For instance, the percentage of sugar in the blood is more important than its estimation in the urine. It differentiates between glycosuria and diabetes mellitus. The carbon dioxid combining power of the plasma indicates the degree of alkalinity.

The blood, for estimation of its various chemical constituents, sugar, non-protein nitrogen constituents and chlorids, should be drawn on a fasting stomach, preferably before breakfast.

Stool.—The feces should be passed into a sterile container without the admixture of urine, and, if possible, examined at once or within a few hours owing to the changes caused by decomposition. When search for amebæ is to be made, the vessel must be warmed and kept warm until examined. When cellulose is excluded from the diet, about 75 per cent by weight of a normal stool is water, the remainder being food residue and bacteria, a large proportion of which are dead. Bacteria constitute about 30 per cent of dried feces in normal and constipated persons (A. Schmidt, Strasburger). The examination is macroscopic, microscopic, bacteriological and chemical.

Consistence.—*Normally*, the stool is formed or semisolid, without mucus. The part first passed is firm but the last portion, coming from a higher level in the bowel is softer. Large, fecal masses composed of small dry balls or boluses closely packed together are usual in habitual constipation. In diarrhea, or dysentery, the frequent small stools may contain pathologic discharges—mucus, pus, and blood. Certain diseases have characteristic dejecta as the “pea-soup” stool of typhoid fever and the large, pale, frothy stool of sprue.

Concerning Mucus.—When small in amount and intimately mixed with the stool, its probable source is the small intestine. Large amounts, not well mixed with fecal matter, indicate inflammation of the colon. Stools composed almost wholly of mucus and streaked with blood are the rule in dysentery, ileocolitis and intussusception. Complete mucous casts of the bowel may be formed in membranous enterocolitis.

Color.—Normally it varies from light yellow to dark brown. The chief normal pigment of the feces is urobilin which is formed from bilirubin by oxidation. Diet and drugs modify the color. An exclusively milk diet gives a light yellow, fatty stool; spinach, a green color; berries, dark or black; calomel in large doses, green, due to biliverdin; iron or bismuth, dark brown or black.

A golden yellow stool is usually due to unchanged bilirubin; green stools occur in fermentation and especially in diarrhea in children. Clay-colored or "acholic" stools occur when bile is deficient, usually due to obstruction of the biliary passages; rarely to deficient hepatic secretion. Clay-colored stools of a greasy appearance, and consisting largely of fats or their derivatives, are common in conditions like tuberculous peritonitis, which interfere with the absorption of fats, and in pancreatic disease. Tarry black stools may occur when the source of bleeding is the stomach or upper intestines; dark brown or bright red when its source is in or nearer the rectum. Red streaks of blood on the surface of a formed stool are due to lesions of the anus or the rectum.

Odor.—Normal, offensive odor is due to products of decomposition, chiefly indol and skatol. In protein putrefaction, the normal odor is much exaggerated. In fermentation, the odor is extremely foul (often that of butyric acid). *Pathologically*, in ulcerative lesions, especially carcinoma, the odor is fetid.

Reaction.—To be of value, this test should be made immediately the stool is passed. Normally the reaction varies from neutral to acid (litmus). In protein putrefaction it is alkaline; in carbohydrate fermentation, acid.

Concretions.—The usual concretions are gall-stones or fecoliths. When bismuth is taken over long periods it may form fecoliths.

Microscopic Examination.—The microscope reveals undigested food remnants, neutral fats and fatty acid crystals. Epithelium is normally exfoliated from the mucosa, and abnormally, red blood-cells and pus are observed. Sloughs of the body tissues are necrotic and worthless for examination.

Ova and Parasites.—We may find either parasites or segments of them macroscopically, or by diluting a portion of the stool with water and centrifuging, we may discover ova under the microscope.

If amebic infection is suspected, a particle of mucus is taken from the warm stool and examined at once on the warm-stage of the microscope. A more reliable method is to obtain the specimen directly from an amebic ulcer through the proctoscope.

Carbohydrate Fermentation.—This is judged from the general appearance of the specimen. The stool is usually soft, mushy and greasy. If gas bubbles are not shown immediately, they will appear if the container is sealed for twenty-four hours or longer.

Protein Putrefaction.—This is also judged from the general appearance of the specimen. It is alkaline in reaction, formed and dry.

Bacteriological examination is by smears and cultures.

Stained Smear.—A small particle of stool is diluted in a drop or two of

water and made into a thin smear. This is dried over a flame and stained by Gram's method. Then under the oil immersion lens the relative percentage of Gram-negative and of Gram-positive organisms is estimated. *Normally* there are approximately 70 per cent Gram-negative and 30 per cent Gram-positive.

Expressed tersely: *Carbohydrate fermentation*—acid reaction, Gram-negative organisms predominating. *Protein putrefaction*—alkaline reaction, Gram-positive organisms predominating.

	PROTEIN PUTREFACTION	CARBOHYDRATE FERMENTATION
Color of stool	Dark brown or yellow	Greenish or brown
Odor	Normal, offensive or sweetish	Very foul (often butyric)
Consistence	Formed, dry, hard	Mushy, soft, semifluid
Reaction	Alkaline	Acid
Stained smear	40 to 100 per cent Gram-positive 60 to 0 per cent Gram-negative	80 to 100 per cent Gram-negative 20 to 0 per cent Gram-positive

Discovery of the typhoid-dysentery group is significant in the diagnosis. Numerous pyogenic cocci in the stool may indicate an ulcerative lesion of the mucosa or that an abscess has ruptured into the gut. Numerous cocci in a direct smear should be confirmed by culture. Hemolytic streptococci, sometimes found in large numbers, may be pathogenic or not. Tubercle bacilli are isolated from the stool with difficulty and when found are open to the error of probably having been swallowed in the sputum.

Chemical Examination.—Chemical tests for occult blood are valueless unless the patient has been on a diet from which meat is eliminated for two or three days and lesions of the anus and rectum have been excluded as sources of hemorrhage. The author has frequently encountered the error of substituting a chemical test for the positive evidence of a direct local examination.

Urobilin, derived from the hemoglobin, is the principal normal pigment of feces. An abnormal amount of urobilin in the feces indicates excessive destruction of red blood-cells. When for any reason the quantity of bile is diminished, the urobilin in the feces is diminished.

Occult Blood (Benzidin Test).—In slight hemorrhage of stomach and upper intestine. To a small amount of benzidin in a test-tube, add 1 to 2 c.c. of glacial acetic acid. Boil. Add 4 to 6 c.c. of hydrogen peroxid until white cloudiness appears. Add specimen of stool. Blue color is positive.

Pathologic Discharge.—Pathologic discharges are composed of mucus, pus and blood, either separately or in combination. *Mucus* is a physiological secretion of the entire colon and rectum and a normal constituent of the feces, but in quantities not grossly recognizable. Irritation or inflammation cause the muciparous glands to secrete large quantities of mucus. It is the most common of the pathologic discharges in coloproctitis, and in mucomembranous colitis it may be expelled in the form of a coil of the bowel. Scybala, retained in the

rectum, internal hemorrhoids and adenomata may cause excessive secretion of mucus.

Pus.—Discharge of pus alone is usually due to the opening of an abscess into the bowel. Usually it is admixed with mucus or blood, or with both.

Mucopus.—Mucopus invariably indicates an ulcerating or granular surface and occurs regularly in the various forms of ulceration, including ulcerative colitis, stricture and ulcerated neoplasms.

Blood.—The principal lesions characterized by bleeding are internal hemorrhoids, fissure, ulceration, hemorrhagic coloproctitis, neoplasms and hemorrhage resulting from trauma. Hemorrhoidal bleeding usually follows the stool and at times spurts in a fine stream from a single ulcerated vessel. A blood-streaked stool is characteristic of fissure. In the case of simple growths, as adenomata, fresh blood is virtually expressed from them during the act of defecation. In ulcerated carcinoma the blood is admixed with mucopus and passed with or independent of the stool. If the malignant growth is situated high, clots of almost pure blood may be passed frequently, the patient being actually constipated.

In evaluating this symptom, it must be borne in mind that blood passed per anum may have been swallowed or have its origin in a lesion of the stomach or adjacent intestine. In such instances it is mixed intimately with the feces, is dark in color and, as a result of the action of the digestive ferments, is more or less degenerated.

Secondary anemia, characterized by a low color index, develops quickly after severe intestinal hemorrhage, and more slowly but quite surely from regular loss of blood from bleeding internal hemorrhoids and ulcerative lesions of the mucosa.

Leukocytosis with a high polynuclear count occurs in abscesses under pressure and in acute diverticulitis. In parasitic infections of the colon, the eosinophils may be increased to 7 per cent, or more, of the total white cells.

PREPARATION OF PATIENT FOR OPERATION

Preparation of the patient for a rectal operation varies with the nature of the case. It is always desirable to have the rectum empty. For hemorrhoids, fissure and fistula operations, our usual routine preparation is a light supper the evening before operation, a hot bath and at 10 P.M. 1 to 2 ounces of castor oil. At 7 A.M. a cup of black coffee and an enema of plain water or soapsuds. Drinking of water is allowed freely until one hour before the operation. At 9 A.M. the patient enters the hospital where the local preparation is made. The perianal skin is shaved, but it is preferable to omit the shaving, in hemorrhoids, if the growth of hair is light, for the new growth is quite annoying. With gauze swabs the skin is thoroughly cleansed with green soap and water, rinsed with sterile water, and a sterile gauze compress applied with a T-binder. The operation is performed at 11 A.M. or 2 P.M. Thus, four or more hours will have elapsed since the administration of the enema, by which time it should be

entirely expelled. On the operating table, $3\frac{1}{2}$ per cent tincture of iodine is applied to the anus and surrounding skin and the rectum wiped out with sterile gauze swabs. By thus making part of the preparation at home, the patient is in the hospital only a few hours before operation.

If the operation is scheduled for 8 or 9 A.M., the cathartic should be taken thirty-six hours before and the enema given the evening before the operation.

When operating for carcinoma of the rectum or sigmoid, it may require several days of preparation to free the bowel of scybala impacted above the growth. A saline purgative for three or four days and one or two colonic flushings daily with 2 per cent hydrogen peroxid are usually effective. These measures are best carried out in the hospital. As a rule, cases requiring major surgery should be in the hospital for observation several days before the operation, not only to empty the bowel but for a prescribed diet, general physical examination and laboratory tests of the blood, urine, etc.

CHAPTER IV

ANESTHESIA

An important question in surgery of the pelvic colon and rectum is the choice of the anesthetic. Anesthesia is secured either by inhalation or by methods of local or regional injection of anesthetizing solutions.

GENERAL ANESTHESIA

General anesthesia is indicated in children, in nervous individuals who may prefer it, occasionally to obtain complete relaxation for diagnostic examination, and for the performance of certain operations, notably the incision of abscesses situated above the pelvic diaphragm, complicated fistulæ, cancer of the rectum and pelvic colon and other operations on the sigmoid.

To produce sufficient abdominal relaxation, all general anesthetic drugs must saturate the central nervous system and the other vital organs of the body. They disturb the permeability of the cell-membranes and interfere with internal respiration and combustion, thus producing or tending to produce acidosis. They do not prevent the harmful stimuli of surgical trauma from reaching the brain. They are, therefore, shock-producing agents by their direct deleterious action on the brain, liver and adrenals, and by their omission to protect these organs from operative injury (Labat).

The practical anesthetics for general narcosis are ether and nitrous oxid gas and oxygen. Chloroform has no place in rectal surgery.

Ethylene (CH_2CH_2), introduced as an anesthetic about six years ago by W. E. Brown of Toronto and Luckhardt and Carter of Chicago, is a colorless gas, lighter than air, forming the essential part of illuminating gas. Because of its inflammable and highly explosive character, it precludes a naked flame or electric sparks in or near the operating room. Its use is practically limited to administration by a trained anesthetist in the hospital.

Induction causes less excitement than nitrous oxid and recovery from anesthesia is rapid and complete. No untoward effects have been observed on the lungs, kidneys or blood. Muscular relaxation is greater than with nitrous oxid, but not sufficient for upper abdominal operations and those requiring the Trendelenburg position. It is quite satisfactory in children and the aged and in cases complicated by acute pulmonary lesions and hyperglycemia.

Cabot and Ransom, in an experience with ethylene in 11,607 cases, in 70 per cent of which ethylene alone was used, conclude that although relaxation is not complete, it gives greater relaxation than nitrous oxid and oxygen; avoids

cyanosis; is apparently free from danger, apart from the possibility of explosion; and its effect on the kidney function is less deleterious than that of ether. Postoperative pneumonia did not develop in any case in which ethylene alone was used. An initial rise in blood-pressure, averaging 17 per cent, is followed by a rapid fall. This prompt early rise in pressure gives ethylene an advantage over chloroform or ether when shock is present.

Nitrous oxid-oxygen alone is safe only to produce analgesia; for prolonged deep anesthesia it is dangerous. Its disadvantage is that it raises the blood-pressure and does not produce muscular relaxation. Its chief field of usefulness in proctology is for minor surgical procedures, as opening an abscess, dilatation of the anal sphincters or removal of the packing of a deep wound.

Ether is administered by the open-drop method or by the closed method. For the latter a special apparatus with a gas-bag for rebreathing is employed. After the patient is under the influence of the nitrous oxid gas, a change is gradually made to ether (gas-ether sequence); or, while gas and oxygen are continued, sufficient ether is added, drop by drop, to maintain complete relaxation. The latter is the most satisfactory method of general narcosis, but requires a special apparatus and an experienced anesthetist. In competent hands comparatively little ether is used, the patient recovers quickly and the anesthesia thus produced increases only slightly the surgical shock. A competent anesthetist is an essential factor to a successful general narcosis. His skill, in administering just the proper amount of the anesthetic to produce relaxation without "drowning" the patient, in observation of the general condition of the patient and notation at intervals of the blood-pressure, contributes largely to the success of the operation.

LOCAL AND REGIONAL ANESTHESIA

Local *infiltration* anesthesia is described under the technic of the various operations in which it is applicable, such as for hemorrhoids and fissure.

Sacral Anesthesia.—Anesthesia produced by injecting the sacral nerves has now become a standardized, safe and effective procedure, especially adaptable to urologic and proctologic surgery. There are two practical methods of blocking the sacral nerves, first and simplest through the sacral hiatus, termed *caudal*, *epidural* or *extradural block*; the second method is by injecting the nerves through the posterior sacral foramina, termed *transsacral block*. A combination of caudal and bilateral transsacral block constitutes a *sacral block*.

Caudal Block.—The sacrum in the adult is a fusion of five vertebræ, decreasing considerably in size from above downward, thus giving the bone a wedge-shaped form, curved backward. The lower portion of the sacrum is quite superficial, but its upper portion is placed much more deeply. For purposes of sacral anesthesia, the important landmarks are the posterior superior spines of the ilia and the sacral cornua. The latter mark the lateral boundaries of the sacral hiatus. Its apex is marked by the fourth sacral spine. Absence of the fifth sacral arch accounts for the hiatus which is covered by the sacrococcygeal

membrane. Accurate recognition of the sacral hiatus is usually readily made by identifying the sacral cornua which present to the palpating finger a distinct depression between them about 1 inch above the tip of the coccyx. The hiatus is roughly triangular in shape, its apex being formed by the fourth sacral spine which marks the lower end of the sacral crest, and its base corresponding to a line drawn through the sacral cornua. The size of the hiatus is extremely variable. Occasionally the fourth and rarely the third sacral arches are absent. Exceptionally all the sacral arches are absent, constituting a sacral bifida. Absent or deficient arches increase the length of the hiatal opening. This has a clinical bearing on the technic, in that the dura may be injured or an intra-



FIG. 88.—CAUDAL ANESTHESIA.

Sagittal section through sacrum. Note dura closing spinal canal and needle in sacral canal. (Courtesy of R. V. Gorsch.)

dural injection made, as normally the dural sac ends between the second and third sacral foramina, or about 6 centimeters above the hiatus. The sacral canal, narrow below and enlarging above, extends the entire length of the sacrum and is continuous with the spinal canal of the lumbar region. It contains a network of veins and lymphatics imbedded in the epidural fat surrounding the dural sac and the sacral nerves. Laterally the nerves lie in tubular prolongations of the dura which blend with the nerve sheaths at about the middle of the foramina. This reflection of the dura, offering some hindrance to the absorption of the anesthetic fluid, explains the occasional unsatisfactory anesthesia and the time required for its completion.

TECHNIC.—As a rule, no preoperative narcotics are administered, unless the patient is very nervous. In some elderly patients we have noted that morphia apparently increased the toxicity of the novocain. The skin is disinfected with

tincture of iodine or 5 per cent picric acid. The patient should be completely relaxed and in the prone position. In the obese a small pillow placed under the pelvis facilitates identification of the landmarks. The left lateral position is almost equally satisfactory for caudal anesthesia. The Labat or similar syringe of 10 c.c. capacity with needles of the best quality fulfill all requirements.

Having clearly defined the hiatus between the cornua, a skin wheal is raised over the center of the hiatus. A spinal puncture needle, held at an angle of about 40 degrees off the horizontal, is now introduced through the wheal, piercing the sacrococcygeal membrane to the anterior wall of the sacral canal. The needle is withdrawn slightly, its hub depressed, and the needle advanced into the canal a distance of 3 or 4 centimeters, following the sacral canal as accurately as possible. The needle should not be introduced more than 4 centimeters, as the fluid diffuses readily throughout the canal and deeper advancement may result in penetration of the dural sac, which normally ends 6 centimeters above the hiatus.

Before injecting any of the fluid, the aspiration test should be made for blood and spinal fluid. If either appears, the needle is withdrawn 1

centimeter and the test repeated. Too much emphasis cannot be placed on injecting the solution slowly, at least three minutes for 30 c.c. We believe that the majority of unfavorable reactions are due to too rapid introduction.

The solution should flow in with ease. This, together with the characteristic feel imparted when perforating the sacrococcygeal membrane, is the best criterion that the needle is actually within the sacral canal. The commonest error is for the needle to slip over the sacral crest. In this event an area of swelling promptly appears over the sacrum shortly after beginning the injection. With due care, caudal injection ordinarily presents no difficulties. The difficult cases are the obese and those with anomalous sacra, which should be appreciated

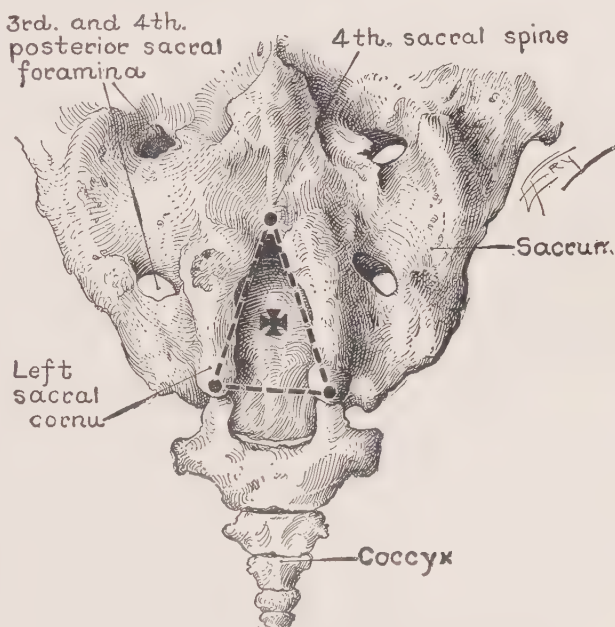


FIG. 89.—CAUDAL ANESTHESIA.

The site of puncture (cross) through the sacral hiatus is the center of the triangle formed by joining the sacral cornua and the fourth sacral spinous process. (Labat, *Regional Anesthesia*. W. B. Saunders Co., Philadelphia.)

beforehand. When caudal injection alone is given, we use from 30 to 40 c.c. of a 2 per cent solution of novocain. If transsacral block is to be combined with the caudal, a 1 per cent solution is used throughout.

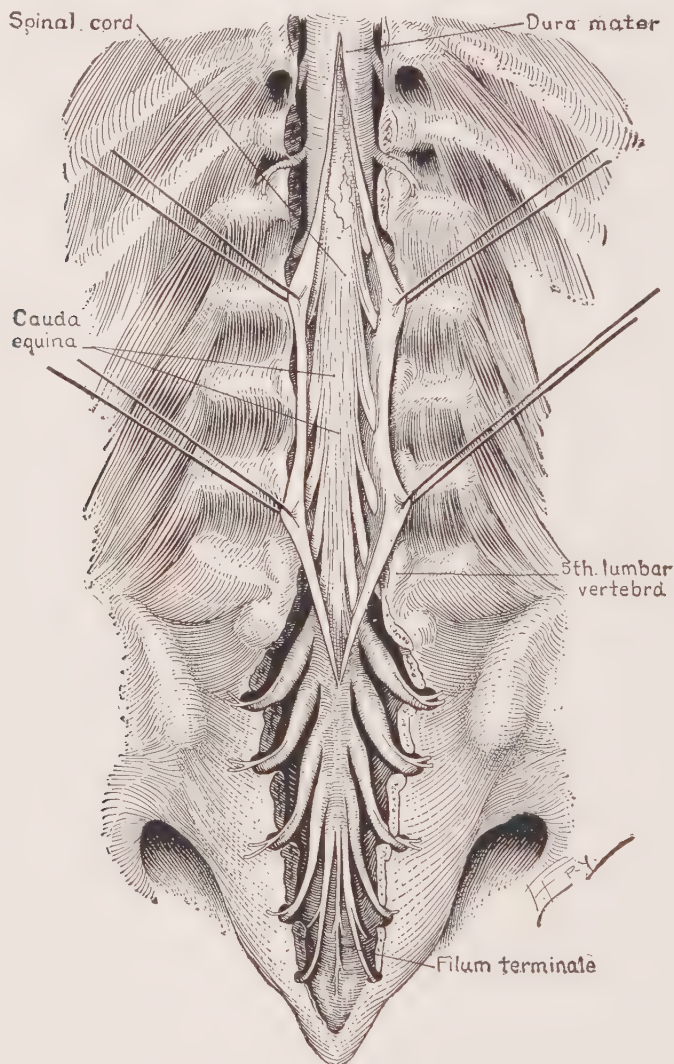


FIG. 90.—CAUDAL ANESTHESIA.

The sacral nerves as seen after resection of the posterior wall of the sacral canal. (Labat, *Regional Anesthesia*, W. B. Saunders Co., Philadelphia.)

The addition of adrenalin, 6 minims of the 1:1,000 solution to 100 c.c. solution of novocain, possesses no advantages in the sacral canal where the low permeability of the dura and the nerve sheaths naturally delay absorption of the solution. In regard to the proposed additions of chemicals, such as bicar-

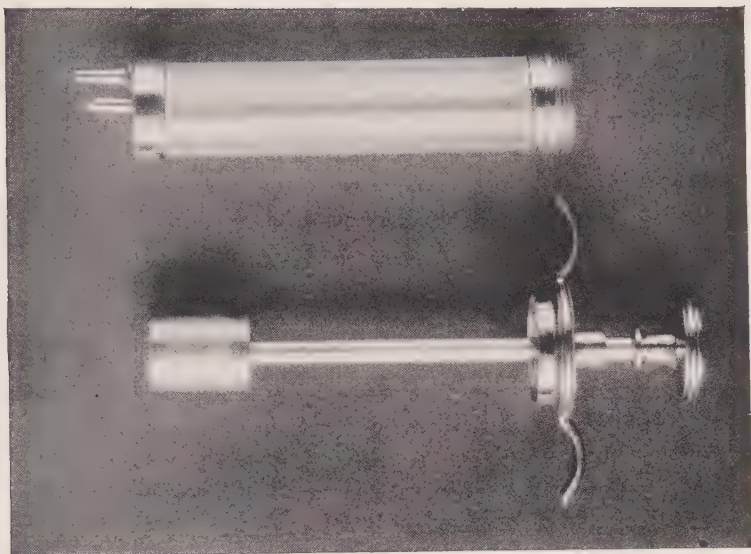


FIG. 91.—LABAT'S REGIONAL ANESTHESIA SYRINGE.

Side view of the barrel; both parts of the syringe have been disconnected so as to show the eccentric tip and bayonet lock. (Labat, *Regional Anesthesia*, W. B. Saunders Co., Philadelphia.)

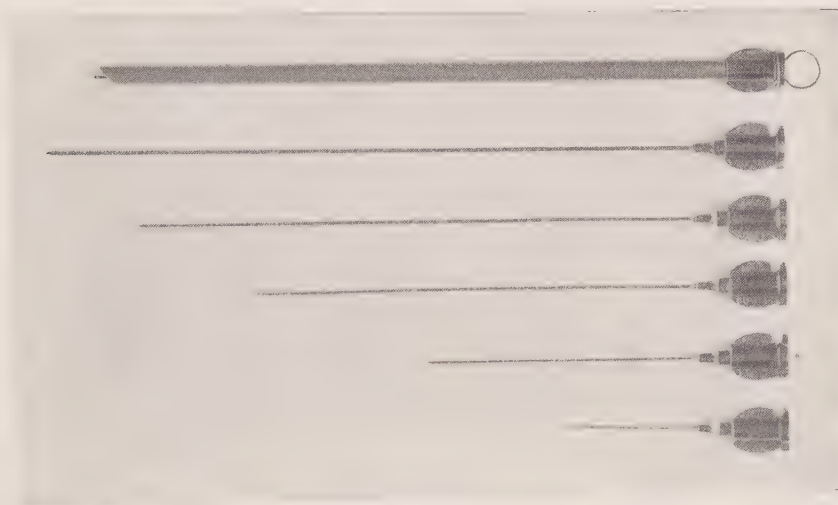


FIG. 92.—LABAT'S REGIONAL ANESTHESIA NEEDLES.

Provided with special bayonet lock hub. Note the slot on one side of the hub and the helix collar. The needle at the top is in its protective shield and has its stylet in. (Labat, *Regional Anesthesia*, W. B. Saunders Co., Philadelphia.)

bonate of soda, potassium sulphate, magnesia, calcium, etc., to "potentiate" the novocain solution, recent experiments tend to show that none of them seems to be of sufficient value to warrant its general use.

Anesthesia following caudal block varies considerably as to time of onset, distribution and completeness of anesthesia. Caudal block alone is successful in about 75 per cent of cases, and when combined with transsacral, the failures are

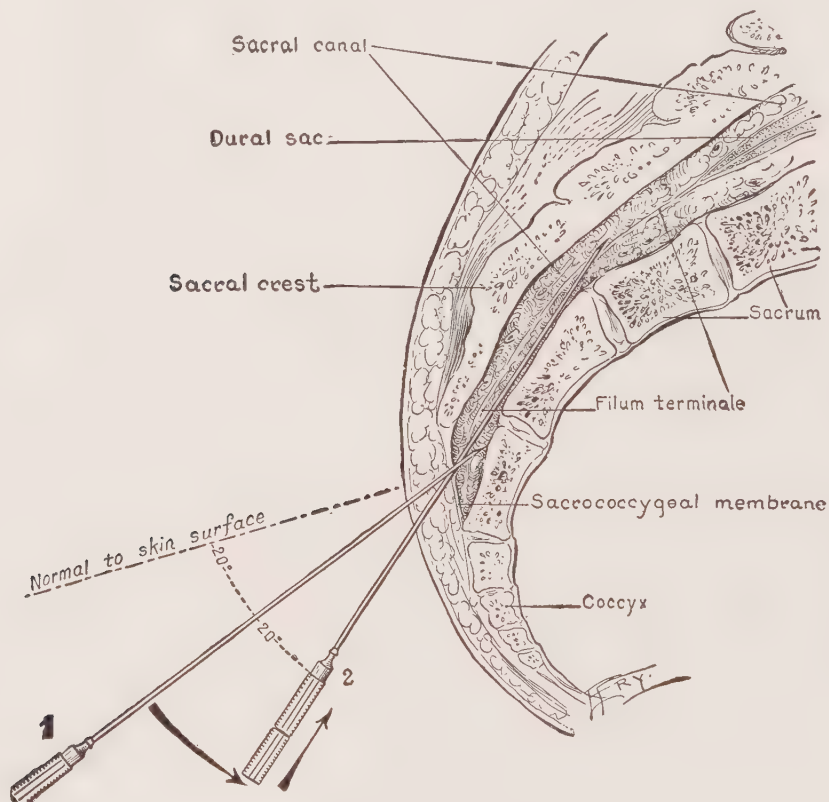


FIG. 93.—CAUDAL ANESTHESIA.

Caudal block. After piercing the sacrococcygeal membrane the needle impinges on the anterior wall of the sacral canal and passes from position 1 to position 2 in the direction of the arrows. (Labat, *Regional Anesthesia*, W. B. Saunders Co., Philadelphia.)

reduced to a minimum. Meeker and School, employing the combined method, report only three failures in 225 cases. Our experience accords with theirs.

The accompanying figure, modified from Thompson, shows the distribution of the anesthesia and its time of onset as regards the sacral nerves. The fourth and fifth sacral nerves, supplying the anus and perianal skin, are anesthetized first, an average of ten minutes sufficing for complete anesthesia. In the regions supplied by the first, second and third sacral nerves, anesthesia follows injection in from ten to thirty minutes. Sometimes the regions supplied by the lumbar and lower dorsal nerves are more or less completely anesthetized by diffusion of

the solution to these levels outside the dura as shown experimentally by Farr and Thompson. No attempt should be made to begin the operation until anesthesia is satisfactory.

Transsacral Block.—For the purposes of transsacral block it is essential to know accurately the relation of the posterior sacral foramina to the posterior superior iliac spines and the sacral cornua, both of which landmarks are palpable in the majority of cases. The sacral foramina, into which the needle must be introduced for successful injection of the sacral nerves, are situated on a line

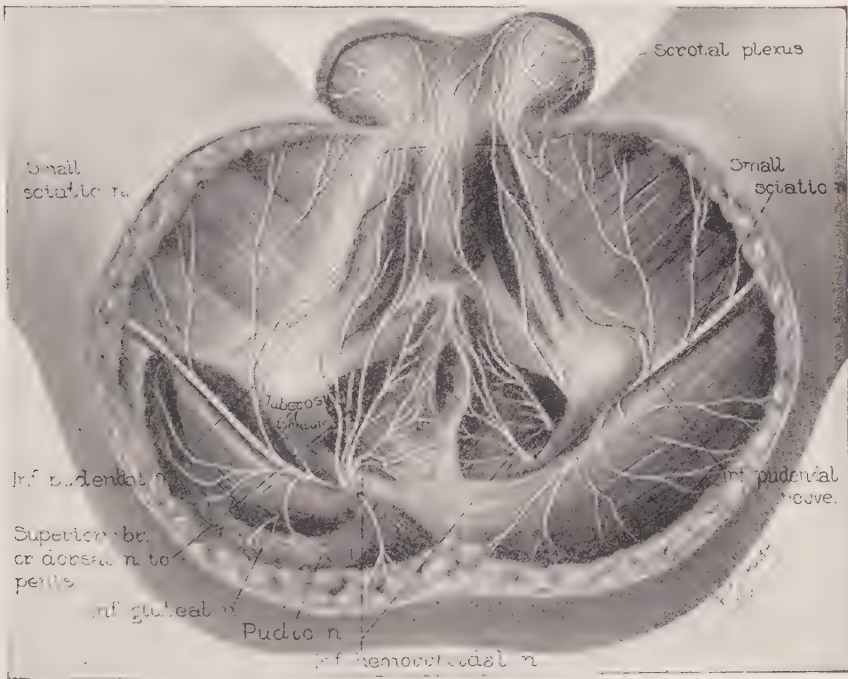


FIG. 94.—CAUDAL ANESTHESIA.

Sensory innervation of the male perineum and anus. (Labat, *Regional Anesthesia*, W. B. Saunders Co., Philadelphia.)

drawn through a point 2 centimeters mesial to the posterior superior spine of the ilium and the sacral cornu of the same side. Four foramina are invariably present. The fifth sacral nerve emerges just below the sacral cornu and its foramen may be incomplete. The foramina are irregularly oval in shape, their average transverse diameter being about 12 millimeters. The second foramen lies 2 centimeters mesial and 1 centimeter below the posterior superior iliac spine. This relation, although fairly constant, is not always so. The first foramen is situated 2.5 centimeters above the second. The distances between the second, third, fourth and fifth foramina are 2, 1.5 and 1.5 centimeters respectively. Corresponding to the thickness of the sacrum, the foraminal canals shorten

rather rapidly from above downward: The first, 2.5 centimeters long; the second, 2 centimeters; the third and fourth, 1.5 centimeters each.

TECHNIC.—The preparation and position of the patient are the same as for caudal block, the two methods now being frequently combined. After definitely locating the posterior superior spine of the ilium, a skin wheal is raised 1 centimeter below and 2 centimeters internal to it. Another wheal is placed just above the sacral cornu on the same side. These wheals mark the positions of the second and fifth foramina respectively. The intervening space is divided into three equal parts by two wheals marking the sites of the third and fourth

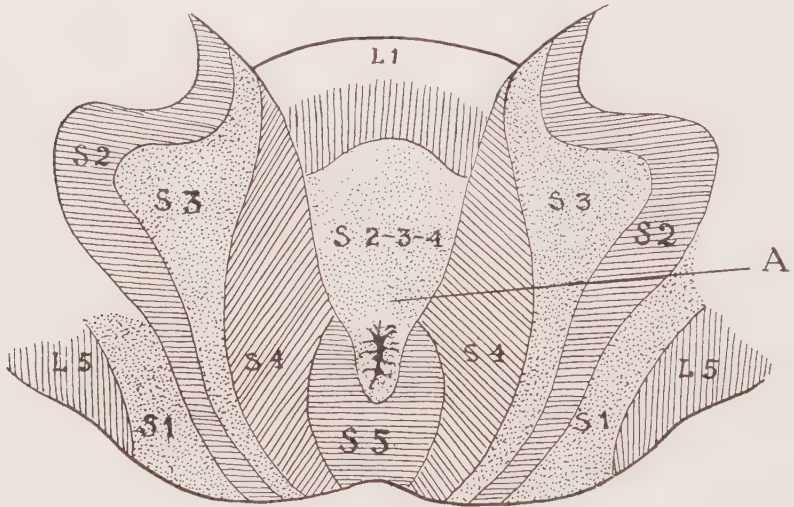


FIG. 95.—SACRAL ANESTHESIA.

(A) S 2, 3, 4, 5 areas supplied by 2nd to 5th sacral nerves. Analgesia complete in fifteen minutes. L 1, L 5 areas supplied by 1st and 5th lumbar nerves. Complete analgesia in thirty minutes. (After Thompson.)

foramina. The second foramen is located first, as its position is most constant and, by leaving the needle *in situ*, serves as a guide to the others. The first foramen is found through a wheal placed 2.5 centimeters above the second.

The needle is passed through the wheal to the bone, perpendicular to the skin surface and then manipulated gently until it enters the foramen through which it is advanced 2 centimeters in the first, 1.5 centimeters in the second, 1 centimeter in the third, and 0.5 centimeter in the fourth. These distances are 0.5 centimeter less than the actual length of the foraminal canals and when carefully observed, the danger of injuring important presacral structures is avoided. The fifth foramen is injected just above the sacral cornua, or if caudal is combined with transsacral block, the fifth nerve can be injected through the cutaneous wheal placed over the hiatus.

Before injecting the anesthetic solution, the aspiration test should be made for blood. If present, the needle is withdrawn slightly. The amount of solution

injected is 6 c.c. for the first nerve, diminishing 1 c.c. for each foramen in sequence. This gives an approximate total of 60 c.c. which, combined with the caudal, approximates a total of 100 c.c. of 1 per cent novocain solution.

Anesthesia, following transsacral block, sets in almost immediately. It lasts generally from two to four hours and is decidedly more certain and constant in

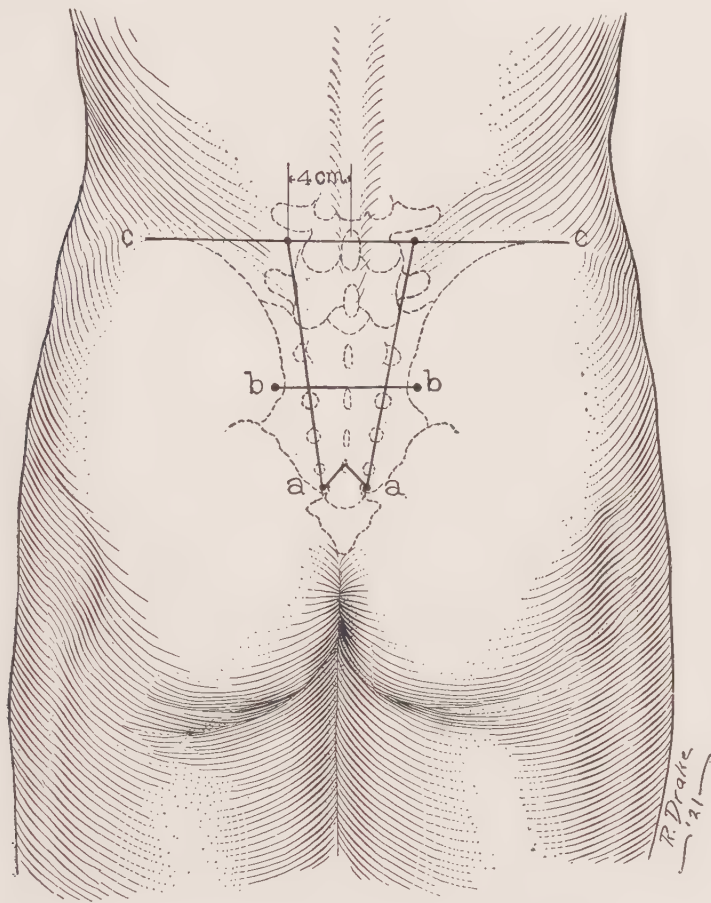


FIG. 96.—TRANSSACRAL BLOCK.

Tracing of the lateral rows of sacral foramina on the skin surface; *a, a*, are the sacral cornua; *b, b*, the posterior superior iliac spines; *c, c*, the line tangent to the highest point of the iliac crests. (Labat, *Regional Anesthesia*, W. B. Saunders Co., Philadelphia.)

its distribution than caudal block alone. These definite advantages justify a combination of caudal and transsacral block, in as much as the latter entails but little additional risk.

From the description given it is evident that proficiency in sacral anesthesia can be acquired only by careful study of the sacrum and its anomalies, and practice on the cadaver in locating the sacral foramina.

Reactions.—Toxic manifestations may occur immediately after sacral anesthesia, such as rapid pulse, cardiac palpitation, mental excitement, nausea, vertigo, pallor and a mild degree of shock. These untoward effects usually subside in a few minutes. The patient should be reassured and atropin and caffeine administered hypodermically.

Accidents, ordinarily avoidable, are intradural injection and breaking the needle in the sacral canal, usually due to a sudden movement of the patient

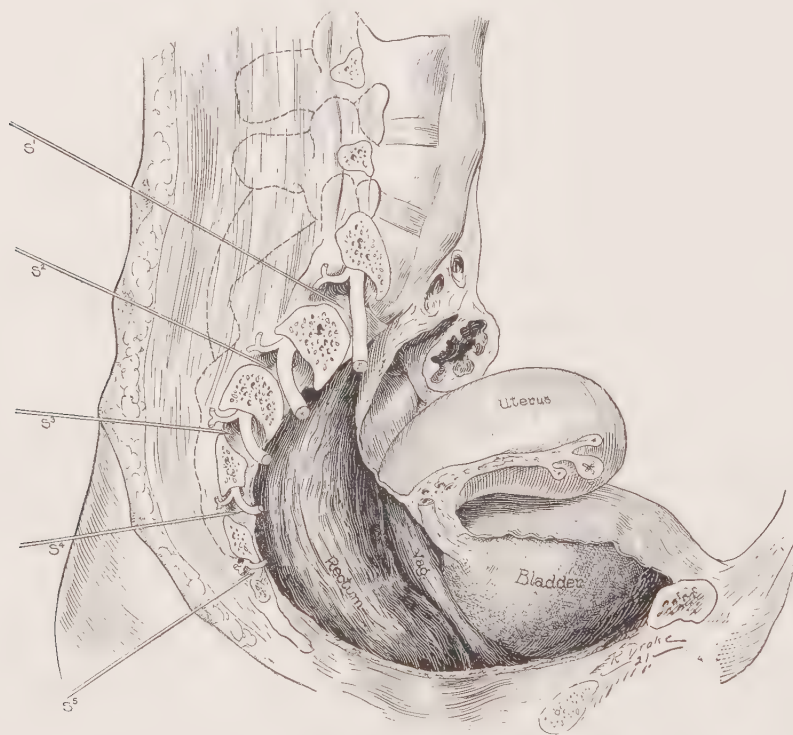


FIG. 97.—TRANSSACRAL BLOCK.

Section of the sacrum passing through the sacral foramina on the right side, showing the thickness of the bone at each foramen: 2.5 cm. at s^1 , 2 cm. at s^2 , 1.5 cm. at s^3 , and from 0.5 to 0.7 cm. at s^4 . (Labat, *Regional Anesthesia*, W. B. Saunders Co., Philadelphia.)

against which he should be warned. Zweifel's patient died after 0.8 gram of novocain had been injected into the dura, but Goldenberg mentions a case of intradural injection with no ill-effects except complete anesthesia of the lower half of the body lasting several hours. Incontinence, or more commonly retention of urine, especially following anorectal operation, is usually transient.

The *operative indications* for caudal and transsacral block are practically the same, but far more satisfactory anesthesia is secured by a combination of the two methods (sacral block). Under sacral block, all operations in and about the anus can be performed successfully, cancer of the lower portion of the rectum

can be extirpated and the second stage of the abdominoperineal operation carried out. Caudal block is especially indicated for implantation of radium into neoplasms involving the anus and rectum.

Occasionally sacral anesthesia fails. The method is contra-indicated in patients susceptible to novocain, when this can be anticipated, and when infection is present in or around the sacrum or coccyx, or in the pelvis. This method is of especial advantage in cases where general anesthesia is contra-indicated.

We have used this type of anesthesia in over 150 cases, in general with satisfactory results. However, it requires a special technic and is time-consuming. In selected cases it is the method of choice, but in minor surgical procedures, as hemorrhoidectomy or the incision of fissure, local infiltration anesthesia is much quicker and quite as satisfactory.

Spinal Anesthesia.—Spinal or intradural anesthesia is an extensive regional nerve-block produced by injecting an anesthetic solution into the subarachnoid space. Suggested by Corning of New York in 1885, August Bier of Bonn, in 1889, was the first to introduce the method, using cocain as the agent. Owing to the dangers attendant upon the use of this drug, spinal anesthesia was more or less discredited until Fournneau discovered stovain in 1903 and Einhorn introduced novocain in 1904. Novocain is the safest and best of the anesthetic drugs discovered to date. Novocain (German), procain (American) and neocain (French) are products identical chemically and in their physiological action. Ten or twelve centigrams of the drug in crystalline form are put up in a sterilized glass ampule of 2 or 3 c.c. capacity. The surface of the ampule is sterilized by immersion in alcohol and is then dried. The solution is made by filling the ampule with the patient's cerebrospinal fluid as it drops directly from the puncture needle. The average dosage is 1 centigram of novocain for each 15 pounds of body weight of patient.

Materials.—Two syringes (5 c.c.), three needles, one for puncture (nickel) 3 inches long, 1 millimeter thick, point sharp, bevel short and with accurately fitting stylet; a second needle to aspirate the fluid into the syringe, and a third to raise a skin wheal and anesthetize the tract down to the dura with novocain, 1 per cent.

One hour before operation, morphin sulphate, $\frac{1}{6}$ grain, and atropin, $\frac{1}{150}$ grain, are given hypodermically to strong patients. For the nervous, hyoscin, $\frac{1}{200}$ grain, exerts a better sedative action.

Position of Patient.—The patient is placed sitting on the table, with feet resting on low stool, and back well arched to separate the spinous processes of the vertebræ. If weakness or some pathological condition prevents the patient from sitting, he is placed in the lateral recumbent position with back well arched. Immediately after the injection is made, he is turned on his back so that the anesthetic fluid may reach both sides of the cord.

The site of puncture varies with the extent of anesthesia desired. The cord ends usually at the lower border of the first lumbar vertebra, but may reach the lower border of the second lumbar. Puncture is made between the second and

third lumbar vertebræ for pelvic and rectal operations; between the third and fourth lumbar vertebræ for operations on the anus, external genitals and perineum.

Landmark.—After preparing a wide area of skin as for a laparotomy, a sterile towel is stretched across the back on a level with the highest points of the iliac crests. This crosses the spinous process of the fourth lumbar vertebra or passes between the fourth and fifth lumbar spines.

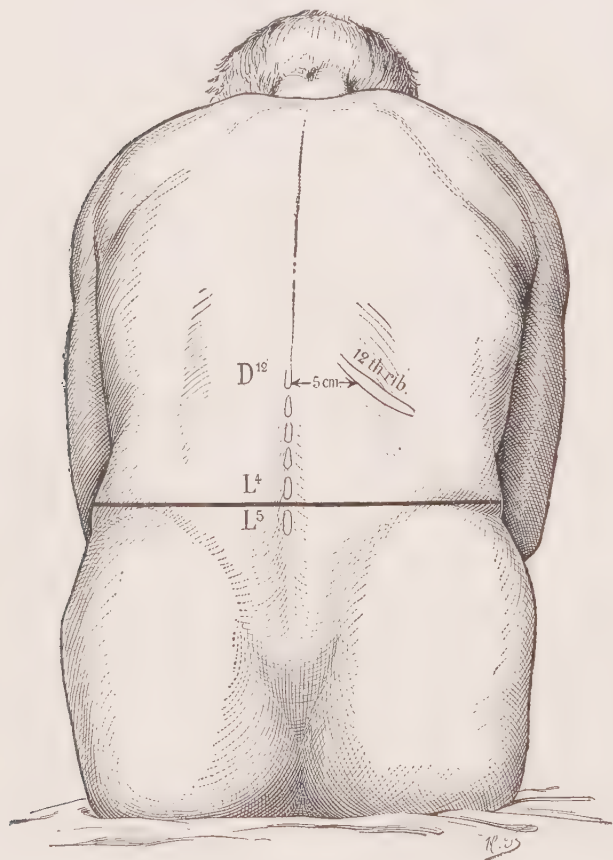


FIG. 98.—INTRASPINAL BLOCK.

Position of patient and landmarks. (Labat, *Regional Anesthesia*, W. B. Saunders Co., Philadelphia.)

Technic.—The skin and tract are anesthetized at the selected point, and the puncture needle introduced in the midline perpendicular to the skin and through the interspinous ligament. Perforation of the dura is indicated by a "snap." Withdrawal of the stylet is followed by a flow of cerebrospinal fluid, perhaps at first in a stream, then drop by drop. The novocain, dissolved in the fluid, is aspirated into the syringe and injected *very slowly* through the puncture needle. When the determined dose has been injected, the needle is suddenly withdrawn and the site of puncture sealed with collodion.

The patient is at once placed flat on his back with a pillow under his head for five to ten minutes, and is asked to breathe deeply, then normally. The Trendelenburg position may be used. Labat considers this slant of the table imperative in all cases during spinal anesthesia, irrespective of the operative procedure. Slow injection favors localization of the drug, while rapid injection causes its diffusion. The drug is rapidly absorbed and fixed by the tissues, exerting its effects particularly on the intraspinal segment of the posterior roots.

The blood-pressure is taken at frequent intervals. It falls 10 to 30 millimeters mercury during the first ten minutes, then gradually rises towards normal. The Trendelenburg position retards respiratory failure, but change to the horizontal must be made very gradually lest temporary bulbar anemia result in symptoms of shock and respiratory failure.

Postoperative Care.—After operation the patient is returned to his bed and a slight Trendelenburg position is maintained for three hours or longer. Fluids are given freely and food is allowed if no untoward symptoms develop.

For nausea during operation, have patient breathe deeply through the mouth, apply cold wet sponges to face and neck, and do not maintain extreme Trendelenburg position. Gauze packed too firmly against the diaphragm hampers breathing and increases nausea. Early respiratory failure is due to too large a dose of the drug or faulty technic, as maintaining the upright position too long. Syncope, due to cerebral and bulbar anemia, is combated by the Trendelenburg position, and large doses of adrenalin intravenously. Caffein, 10 grains, or ephedrin sulphate, $\frac{3}{4}$ grain tablet, may be given by mouth one hour before operation to maintain the blood-pressure.

Headache, which occurs in 3 to 5 per cent of cases after operation, is due to withdrawing too much cerebrospinal fluid or seepage through the dural puncture when too large a needle has been used or multiple punctures have been made. Treatment is by keeping the patient flat on his back, ice-bag to head and a few doses of acetylsalicylic acid. If, after eight hours, there is no relief, spinal puncture is made in the lateral position and 15 to 20 c.c. of fluid withdrawn. It is only occasionally that a second puncture is required on the following day.

Indications.—Indications for spinal anesthesia are based on the condition of the patient and type of operation. It should be restricted to major pelvic and abdominal operations, and those on the lower extremities that do not permit of local or regional methods. Patients over sixty years of age bear spinal with less hazard than general anesthesia. It is the anesthetic of choice in intestinal

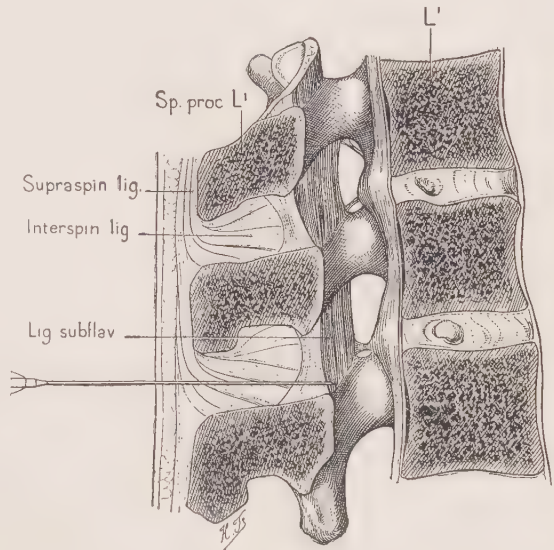


FIG. 99.—SAGITTAL SECTION OF THE LUMBAR SPINE. Showing the direction of the needle which is perpendicular to the surface of the skin. (Labat, *Regional Anesthesia*, W. B. Saunders Co., Philadelphia.)

obstruction and carcinoma of the rectum. In the latter it has raised operability and definitely reduced the mortality.

Contra-Indications.—Contra-indications are low blood-pressure (100-110), shock and pathologic conditions of the spine and brain. Disadvantages are that the anesthesia may be delayed, does not extend to the desired level, or occasionally fails; fall in blood-pressure and respiratory failure. Anesthesia dependable for intra-abdominal operations lasts about one hour.

Mortality.—Babcock, who has reported fifteen thousand personal cases, believes that in selected cases the mortality from spinal anesthesia should not exceed one in ten thousand. Campbell reports its use in 410 urologic cases at Bellevue Hospital, New York, with two deaths, both in moribund septic patients. Martin and Arbuthnot reviewed over six thousand operations performed under spinal anesthesia in the Los Angeles General Hospital. Only six deaths occurred, two the result of an overdose given in error; two, strangulated herniæ with fecal vomiting; one, pulmonary tuberculosis; one, diabetic.

REFERENCES

- CABOT, Hugh, and RANSOM, H. K. *Ann. Surg.*, Phila., Aug., 1927, Vol. 86.
 CAMPBELL, M. F. *Ann. Surg.*, Phila., July, 1926.
 FARR, R. E. *Arch. Surg.*, Chicago, March, 1926, Vol. 12.
 FLAGG, J. P. *Anesthesia*, Philadelphia, J. B. Lippincott, 1928.
 HARRIS, M. L. *Tr. Am. Surg. Ass.*, Phila., 1917.
 KRÖNIG, B. *Operative Gynäkologie*, 5th ed., Leipzig, 1912.
 LABAT, Gaston. *Regional Anesthesia*, Philadelphia, W. B. Saunders Co., 1922.
 MARTIN, H. W., and ARBUTHNOT, R. E. *J. Am. M. Ass.*, Nov. 20, 1926, Vol. 87.
 MEEKER, W. R., and SCHOLL, A. J. *Ann. Surg.*, Phila., Nov., 1924, Vol. 80.
 THOMPSON, J. E. *Tr. Am. Surg. Ass.*, Phila., 1917.

CHAPTER V

CHRONIC CONSTIPATION AND FECAL IMPACTION

CHRONIC CONSTIPATION

Chronic constipation is the habitual retention in the large bowel of the waste products of digestion for an abnormally long period.

Etiologically constipation occurs in two principal forms: *Functional*, due to a failure of the normal physiological processes (pathological physiology), and second, *obstructive*, due to mechanical interference with the passage of the bowel contents by intrinsic or extrinsic gross pathology. The cue for successful treatment rests on ascertaining to which class a given case belongs. Functionally the colon may be divided into two portions. The proximal colon, extending approximately to the splenic flexure, receives the fluid contents of the ileum and by a process of peristalsis and antiperistalsis, and absorption, extracts most of the water and nutrient material. The semisolid residue is moved forward by waves of contraction (peristalsis) into the distal colon beyond the splenic flexure. There is little delay in the descending colon which is never distended and Elliott therefore regards it as a transferring segment of exaggerated irritability. The storage of waste matter takes place chiefly in the sigmoid flexure which, according to Hertz, becomes filled from below upward, and its retention is controlled by the neuromuscular apparatus at the rectosigmoidal juncture. The distinguishing feature of the sigmoid colon and rectum is its complete subordination to the spinal cord centers. Increased distention probably excites reflexly through the pelvic visceral nerves, contraction of the rectococcygeus and the longitudinal fibers of the gut, followed after some seconds by contraction of the circular coat. The latter originates at the lower limit of antiperistalsis, near the upper end of the sigmoid flexure, and spreading rapidly downward empties the sigmoid and rectum and by syphonage action may also empty the descending colon. Emptying of the rectum proper is largely assisted by the contraction of the voluntary muscles of the abdominal wall and pelvic floor and by the diaphragm.

In normal individuals with regular daily bowel action the rectum is usually empty until just before defecation. Distention of the rectum by feces excites the call to defecation. If no response be made, the desire passes as the rectum relaxes and the fecal mass no longer exerts pressure on its wall. Although the rectum is comparatively empty in normal individuals, in the habitually constipated more or less feces are usually present, the rectum is dilated and the

nerve-endings become obtunded so that they do not respond to the normal stimuli.

From the standpoint of pathological physiology there are many causal factors of constipation, as classified by Hewlett: *Lack of normal stimuli* of the intestinal contents on the local neuromuscular mechanism of the bowel wall. These stimuli may be chemical or mechanical. *Chemical stimuli* are the prod-

ucts of intestinal decomposition, as carbon dioxide (CO_2), marsh-gas (CH_4), skatol, etc.

Mechanical Factors.—(a)

Lack of bulk may be *pathological*, due to anorexia from gastric or other disease, constant vomiting; obstruction of esophagus or pylorus, or easily digestible food with scant cellulose residue, as in an ulcer diet; or *physiological*, when gastric hyperacidity results in overdigestion and the stools contain less water, nitrogen, fat, carbohydrates, cellulose and bacteria than normal. Relief of cases due to lack of residue is by adding to the diet food containing non-digestible or non-absorbable material, as agar, bran, etc.



FIG. 100.—DIAGRAM IN WHICH THE ARROWS INDICATE THE NORMAL FECAL CURRENTS (DESCRIBED BY ROITH).

(Coffey, *Gastro-Enteroptosis*, D. Appleton & Co., New York.)

moiditis, tuberculous peritonitis and, in women, inflammation of the organs of generation. Extrinsic pressure may cause partial obstruction as by the retroverted uterus, floating or enlarged kidney or spleen. Pain in this class of cases is due in part to the increased peristalsis proximal to the obstruction.

Functional Motor Disturbances.—Fleiner classifies these into two types: The *atonic*, in which the muscles do not contract firmly on the intestinal contents and presumably there is diminished motility, and the *spastic* type in which it is believed that spasm of certain segments of the colon obstruct the free passage of the intestinal contents. Spasm may affect one segment while other segments appear atonic. Motility is not necessarily affected by atony and spasm. Signs of atony are large caliber and lack of haustral segmentation. Weakness of the

(b) *Bands and adhesions* from acute or chronic peritonitis may complicate or follow cholecystitis, gastric and duodenal ulcer, appendicitis, sig-

intestinal musculature (atonic constipation) occurs in senility, the musculature being atrophied owing to the diminished blood supply due to arteriosclerosis; in cachexia as in cancer or tuberculosis; in rickets, in which there is distention of the intestine with gas and consequent weakening of the musculature; in fevers—acute febrile conditions in which there may be some functional disturbance of the musculature due to the poisons circulating in the blood and high temperature of the body, but there is no anatomical change in the musculature; in obesity, a fatty infiltration is found in the intestinal musculature of stout people; and in flatulence, the muscles of the overdistended bowel must contract with unusual force to maintain the normal rate of progress of the feces and eventually loses its contractile power. Atony of the colon due to a depression of the nervous system, as in neurasthenia and hypochondriasis; in mental disorders, as melancholia, is quoted by some authorities as causal, but others are of the opinion that they are the effect and not the cause of the atony and constipation. Insufficient exercise favors sluggish peristalsis and constipation. Tight lacing of the upper abdomen which depresses the abdominal viscera instead of supporting them tends to produce constipation. Anything that interferes with the afferent nerve impulses which reflexly produce intestinal activity, such as inflammatory conditions of the colon causing thickening of its mucosa, persistent use of cathartics and excessive drinking of strong tea, will result in constipation.

Spastic Constipation.—Spasticity of the gut is in all probability due to lack of coördination between the inhibitory impulses passing along the sympathetic and accelerating impulses passing along the vagus. Increased irritability of the autonomic nervous system may be due to neuropathic conditions associated with the abdominal viscera or pelvic organs; to vagotonia, or to sympatheticotonic association with neurasthenia and hysteria.

The normal motor function of the intestine depends upon the innervation of two opposed systems of nerves, the vagus being motor and the sympathetic inhibitory. These two systems make up the autonomic nervous system. Excessive stimulation of the vagus, or vagotonia, induces muscular spasm of the small intestine, contraction of the colon and other phenomena.

Crämer speaks of excessive smoking as a cause of spastic constipation. This is probably the result of the paralyzing action of the nicotin on the sympathetic ganglia, causing abolition of the tonic inhibition exerted by the splanchnic nerves by means of which the motor activity of the intestine is regulated. When this sympathetic inhibition is in abeyance, normal intestinal stimuli give rise to enterospasm. There is probably an accompanying increased irritability of the vagus.

Neither the occurrence of spasm nor atony is necessarily accompanied by constipation. Either condition may obtain in diarrhea. Spastic constipation usually occurs in association with atony of the bowel. A saccharobutyric intestinal fermentation is usually associated, or the cause of the disturbed physiology may be reflex from a diseased appendix, prolapsed kidney or other extra-intestinal pathology.

Spastic constipation is observed more frequently in women than in men and attacks are precipitated by worry, mental and physical strain. The nervous type of individuals, gynecologic patients and heavy smokers are predisposed to the condition. The transverse and descending colon and the sigmoid flexure are the segments most commonly involved. The patient complains of abdominal discomfort, and occasional attacks of sharp pain and tenesmus which may simulate renal colic, gall-stone disease or acute appendicitis. Ribbonlike stools may occur, due to spasm of the sphincters.

The feces are usually hard and dry but occasionally are soft and evacuated in large bulk. On abdominal palpation the involved colon is tender and the sigmoid feels like a narrow, firm tube, the contraction lasting for several minutes. Diagnosis is aided by x-ray examination which usually shows well-marked haustral segmentation, but occasionally a smooth, gas-pipe appearance. To recognize spasticity of the pelvic colon, sigmoidoscopy is most valuable. The tube is arrested at the rectosigmoidal juncture by a spasm which relaxes after a short interval or may be overcome by inflation of air. Above this point a series of annular contractions may be observed which relax spontaneously.

Segmental spasm may be mistaken for stricture. A physician consulted the writer for what he feared was a stricture. He was toxic, had one to four liquid passages daily, followed by broken, ribbonlike stools and was greatly alarmed as an x-ray plate showed an apparent stricture of the descending colon. The sigmoidoscope was passed with difficulty through a spasmodic rectosigmoidal angle. The mucosa was congested but otherwise negative. A second radiogram showed the descending colon to be of normal caliber, proving that the apparent stricture was segmental spasm.

In as much as evidence of atony or spasm cannot alone be the sole cause of constipation, the more scientific classification of Hertz is adopted to include all types, *viz.*, first, derangement in the passage of food residue from the stomach to the pelvic colon; second, incomplete evacuation of the pelvic colon and rectum at proper intervals. In the first group, passage through the intestine is delayed, defecation being normal; in the second, the intestinal contents reach the pelvic colon without delay but defecation is inefficient. Both conditions may exist in the same patient but usually one is predominant and only this requires treatment.

Dyschesia.—Dyschesia refers to incomplete or delayed defecation, the delay being in the sigmoid and rectum. It may, therefore, be due to inefficient defecation, or to an obstacle to efficient defecation.

The causes of dyschesia are:

1. Habitual disregard of the call to defecation, resulting in a blunting of the sensation, accumulation of feces in the pelvic colon and rectum and their consequent dilatation and muscular atony.

2. Weakness of the voluntary muscles which take part in defecation is frequently overlooked. This may be congenital or due to faulty posture, malnutrition, anemia, prolonged fevers, lack of exercise, pregnancy, abdominal

tumors, ascites, accumulation of subperitoneal or omental fat, large hernia or diastasis of the recti muscles, any of which may result in diminished intra-abdominal pressure. The pelvic supports, especially the levator ani muscles, which may undergo atrophy following difficult labor, may likewise be impaired. Various degrees of enteroptosis result in gaseous distention of the bowel; the diaphragm is in a more or less constant inspiratory position, and it is impossible to produce the requisite rise in intra-abdominal pressure. Consequently defecation is inefficient and the pelvic colon and rectum are never satisfactorily and completely emptied.

3. The correct squatting posture at defecation can be obtained only on a toilet with a low seat. On the modern high-seated toilet the body is placed at a mechanical disadvantage to increase the intra-abdominal pressure, an essential factor in emptying the distal colon.

4. Weakness of the *defecation reflex*, caused either by too little residue entering the rectum, or due to an organic lesion of the lower part of the spinal cord involving the reflex center.

MECHANICAL FACTORS IN DYSCHESIA.—The chief obstructive factors to efficient emptying of the distal colon and rectum are abnormally dry, hard and bulky feces; and, in order, from

below upward: anal fissure and anorectal ulceration, inducing sphincter spasm; cryptitis (sphincteralgia); hypertrophied anal papillæ (obstruction, or pain); internal hemorrhoids, prolapsing into and obstructing the anal canal; hypertrophy and spasm of the anal sphincters and levator ani muscles; hypertrophied valves of Houston, very seldom obstructive; organic stricture of the rectum; neoplasms of the rectum; anterior rectocele, usually associated with a weakened rectovaginal septum; narrow or spasmodic rectosigmoidal angle; and large sigmoid, especially if it is adherent or invaginates into the rectum. Mechanical obstruction to higher segments of the colon is by bands and adhesions



FIG. 101.—EXTREME DISTENTION OF THE CECUM WITHOUT DISTENTION OF THE DESCENDING COLON IN GRADUAL OBSTRUCTION OF THE LOWER BOWEL.

(Coffey, *Gastro-Enteroptosis*, D. Appleton & Co., New York.)

of the bowel and its omentum, especially following abdominal operations and in incarcerated herniæ. Extrinsic causes of dyschesia are tumors, such as fibroids, and uterine displacements, sacrococcygeal neoplasms and the hypertrophied prostate.

Chronic constipation is common in both sexes and at all ages. A complete history is essential. This may show that the food is too concentrated or lacking in quantity to leave a sufficient residue. Overdigestion, especially in the obese, leaves a small residue, and overeating may leave a larger residue than the constantly dilated bowel can handle.

Constipation in infants and children is frequently due to anomalies of development of the gastro-intestinal tract, notably an abnormally large sigmoid flexure; but especially to dietetic errors and failure on the part of parents to inculcate the habit of regular bowel evacuations at a stated time and thus establish physiological action. Repressive measures in schools cause children to postpone the call of nature, and inadequate facilities and toilets with seats too high place them at a mechanical disadvantage to efficiently perform the act. Constipation frequently develops at puberty, especially in girls with a sense of false modesty.

Lack of exercise may be causal and constipation frequently follows changing from an active occupation to a sedentary life. Abuse of cathartics is a fruitful source of constipation. Obstipation (mechanical constipation) not infrequently dates from an abdominal operation and consequent intestinal adhesions. The upright posture of man favors sluggish peristalsis in enteroptotics who do not wear properly adjusted abdominal supports, and in the emaciated.

Physiologically, defecation should occur after every meal. Ingestion of food initiates a wave of peristalsis that, theoretically at least, should result in evacuation of the terminal bowel. Practically this is said to be so among some aboriginal tribes. The conventions of civilization, however, have so disturbed physiology that for most individuals one or two bowel actions daily are considered normal. The preferable time is on rising or after breakfast, the bowel being educated by habit to function at this time. A drink of cold water, the morning bath, and breakfast are all favorable factors operative at this time. There are, however, wide variations from this general rule. Many persons empty the bowel only once in two or three days, once weekly, or even at longer periods, without evident ill effect on their general well-being. Very frequently individuals who have a daily bowel action are really constipated as the evacuation is insufficient in quantity. X-ray studies indicate that the descending colon, sigmoid flexure and rectum should be emptied by a physiological bowel action. Voluntary inhibition of defecation in sufferers from painful anal lesions, as fissure, frequently defers defecation for lengthening periods because of the pain thereby excited, and constipation ensues.

Symptoms.—The symptoms may be mild and few, or severe. Usually there is a feeling of lassitude, a dull headache and furred tongue. Coprostasis affects

the physiology of the colon, resulting in a feeling of weight and fullness in the lower abdomen, abdominal distention, flatulence, borborygmi and colicky pains.

Complications.—Local conditions resulting from straining and the passage of hard stools are hemorrhoids, fissure, pruritus and occasionally prolapse.

Stasis Toxemia.—The decomposition products of the intestinal contents, retained for an abnormally long period, when absorbed, give rise to a train of symptoms which may be designated as stasis toxemia. Some fifteen years ago Sir W. Arbuthnot Lane, who coined the term, defined chronic intestinal stasis thus: "By chronic intestinal stasis, I mean that the passage of the contents of the intestinal canal is delayed sufficiently long to result in the production in the small intestine especially, of an excess of toxic material, and in the absorption into the circulation of a greater quantity of poisonous products than the organs



FIG. 102.—SIGMOID WITH SHORT MESENTERY, FIXED BY PELVIC ADHESIONS (DIAGRAMMATIC).



FIG. 103.—ACUTE ANGULATION OF SIGMOID, WITH ADHERENT CHRONIC APPENDIX (DIAGRAMMATIC).

which convert and excrete them are able to deal with." Hence "stasis" includes both abnormal delay and intestinal toxemia. During the few years following Lane's teaching, the subject received intensive study especially in its surgical aspect by several American surgeons.

"Ascending stasis," or abnormal delay in the cecum and ascending colon, may be due to enteroptosis, usually of congenital origin. Physiologically, increased antiperistalsis results in abnormal delay, as does spasm or organic obstruction in the colon beyond.

Anomalous membranes often play an important part in the production of stasis. They are frequently associated with enteroptosis but may occur independently. These membranes are usually anomalies of development of the peritoneum and seldom, if ever, the result of prenatal inflammation. In dissections of a large number of infants, S. C. Harvey found congenital variations in the relations of the peritoneum to the right colon, appendix and terminal ileum in 15 to 20 per cent of the subjects examined. In structure, even in adults, they resemble layers of peritoneum held together by areolar tissue. Thickened and more fibrous bands are explained on the basis of an inflammatory reaction to the persistent strain, or to irritation and low-grade infection from the delayed bowel contents.

The membranes of clinical significance in connection with the colon are:

1. The hepatoduodenocolic, extending from the gall-bladder to duodenum and right end of transverse colon (Taylor). By binding the colon and pylorus together, distention of either segment hampers the function of the other.

2. Jackson's membrane—a peritoneal-like veil extending from the postero-lateral peritoneum of the right flank to and over the cecum, ascending colon and hepatic flexure, fusing in some cases with the mesentery of the small intestine. This membrane usually slides quite freely over the colonic peritoneum, a little areolar tissue only intervening, and does not appreciably affect bowel function. In some cases, however, thickened transverse zones in the membrane may cause bowel constriction, or the whole membrane may shorten and hamper intestinal function. In other cases the veil is represented by one or more bands extending



FIG. 104.—SIGMOID FIRMLY ADHERENT TO RIGHT UTERINE CORNU AND ITS ADNEXA, CAUSING ACUTE FLEXURE OF BOWEL AND OBSTIPATION (DIAGRAMMATIC).



FIG. 105.—PROXIMAL AND DISTAL LOOPS OF SIGMOID ANGULATED AND OBSTRUCTED BY ADHESIONS OF THE PERITONEUM AND THE APPENDICES EPIPLOICÆ.

to the colon. When thick and short these membranes may interfere seriously with bowel function by distortion, constriction and kink-formation.

Cecum mobile is a fruitful source of retention. The dilated cecum, occupying a low pelvic position, joins the ascending colon at an angle and works at a mechanical disadvantage in expelling its contents. Cecal distention and traction by bands or adhesions may interfere with the normal closure of the ileocecal valve, cause delay (stasis) in the terminal ileum and retrograde infection of the ileum.

3. Lane's kink is an angulation in the distal few inches of the ileum, due to its being pulled down, fixed and partially obstructed by a membrane extending from a point in the ileum near its terminus to the pelvic peritoneum.

The vermiform appendix, by inflammatory adhesion to the bowel or other point, may play an obstructive rôle.

Adhesions and Kinks of the Colon.—Adhesions of the colon are usually secondary to intra-abdominal inflammation (and intraperitoneal operations), but they may follow colitis or ulceration of the bowel. The adhesions may involve local points only or large segments of the bowel. As a result the bowel

may (a) be fixed to the peritoneum directly or by intervening fibrous bands; (b) be attached to another viscus, as sigmoid to uterus or bladder; (c) be segments of colon adherent to each other, forming an angulation.

The appendices epiploicæ are prone to inflammation and form bizarre adhesions to adjacent structures. Angulations and kinks of the sigmoid are frequently the result of its mesentery being shortened and thickened by inflammation.

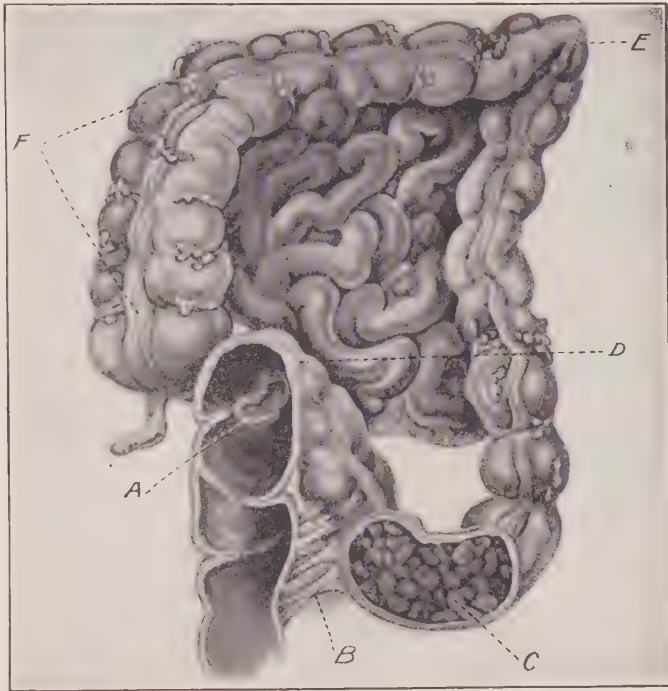


FIG. 106.—IMPORTANCE OF LAST SIGMOID KINK IN CONNECTION WITH INTESTINAL STASIS OR CONSTIPATION (Axtell).

A, ulceration; B, adhesions; C, impacted and prolapsed sigmoid; D, acute angulation at rectosigmoid juncture; E, angulation at splenic flexure; F, enlarged and distended cecum. (Coffey, *Gastro-Enteroptosis*, D. Appleton & Co., New York.)

Abnormal delay in the emptying of the colon is therefore dependent on three factors:

1. Atony (atonic constipation), in which the peristaltic and expulsive power is deficient, probably due to some degeneration of the neuromuscular control.

2. Mechanical obstruction (obstipation). Peristalsis may be normal but adventitious bands, adhesions or other obstructions mechanically interfere with the passage of the bowel contents.

3. Deficient stimuli to peristalsis by the food residue being quantitatively or qualitatively deficient.

Abnormal delay may give rise to no symptoms. The stool may contain large quantities of the products of protein putrefaction, while the urine contains relatively few; or the urine may show a marked excess of aromatic bodies while the stools appear comparatively normal. It naturally follows that it is the toxins retained in the circulation only that act deleteriously on the body-cells. Their quantity depends upon intestinal putrefaction of proteins, the integrity of the intestinal mucosa, the detoxicating action of the liver on the circulating toxins,



FIG. 107.—GASTRO-ENTEROPTOSIS, LATERAL VIEW.

The pendulous lower abdomen is aggravated by thinning and weakness of the abdominal wall at the site of the vertical laparotomy scar. Female, aged 37 years.



FIG. 108.—PHOTO OF WOMAN OF ASTHENIC HABITUS (Mills).

Characterized by general frailty, light body weight, very long gracile shallow thorax with acute intercostal angle. Short abdomen longitudinally, wide pelvis. (Coffey, *Gastro-Enteroptosis*, D. Appleton & Co., New York.)

the integrity and efficiency of the endocrine glands (the thyroid, the adrenals and the pituitary body), and the efficiency of the emunctories in elimination, especially the kidneys. Consequently the immediate active processes in toxemia are bacteriologic and biochemical.

Pathology.—As the circulating toxins bathe all the tissues of the body, the pathology of intestinal toxemia is represented by irritation and chronic degenerative changes of any organ or group of organs, as the nervous system, the cardiovascular system, the respiratory system, the synovial membranes and the skin. Experienced clinicians are familiar with the association of bronchial asthma with stasis toxemia. In a number of such cases both in adults and in

children, we have corrected the stasis and the asthmatic symptoms have promptly subsided.

Clinically the majority of cases of stasis toxemia present two types:

1. The *sthenic*, robust individual with symptoms of pain and perverted bowel function due mainly to mechanical obstruction. The dominant feature is pain, tenderness and distention in the right side of the abdomen. There is a delay of bowel action but the symptoms of toxemia are slight. If unrelieved, toxic symptoms later gain ascendancy. X-ray examination usually shows a delay of twenty-four to forty-eight hours in the right colon, distortion of the colon, a mobile cecum, if present, and an incompetent ileocecal valve.

2. The other type comprises the *asthenic*, enteroptotic, weak and emaciated. The symptoms of intestinal toxemia predominate, while the chief abdominal symptoms are constipation and flatulence. The abdomen is soft but prominent while standing. The x-rays demonstrate enteroptosis as the characteristic feature and a delay of forty-eight hours or longer in the right colon.

Diagnosis.—The history is very suggestive but a thorough physical examination should be made before beginning treatment.

The patient's statement that cathartics are not effective but that response to enemas is prompt signifies that delay is in the distal bowel. If a pint or less of water or soap solution produces free evacuation, the delay is probably in the rectum and pelvic colon; if a larger quantity of fluid is required, delay is at a higher level. Inspection may show a faulty posture while standing, a deformity, or the pendulous abdomen characteristic of enteroptosis. Ataxia, absent patellar, or altered pupillary reflexes may explain a constipation due to a lesion of the central nervous system. External herniæ may be seen or felt. With the patient recumbent, systematic examination of

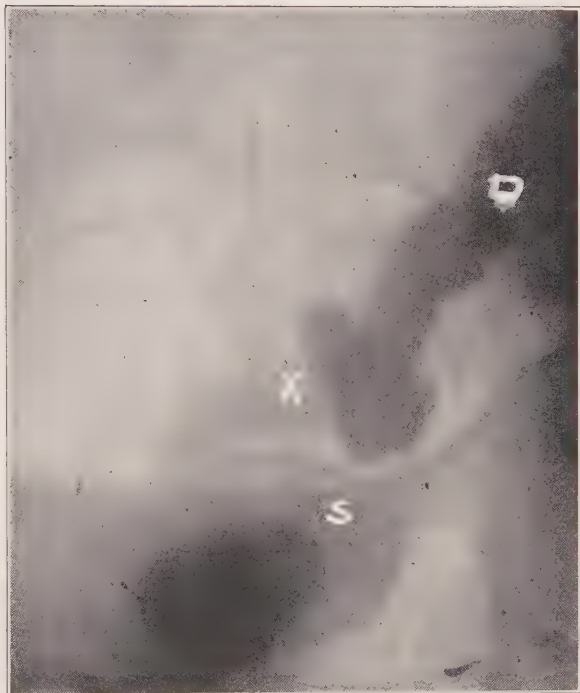


FIG. 109.—ADHESIONS CAUSING CONSTIPATION.

Female, aged fifty-two. Obstructive symptoms relieved by freeing perisigmoidal adhesions, mainly great omentum. D, descending colon; S, sigmoid; X, irregular area at junction of iliac and pelvic colon.

the abdomen is made for points of tenderness, enlarged or displaced organs (kidney, liver), masses and tumors as described in the chapter on Diagnostic Methods (*q.v.*). The rectum is next examined to detect painful lesions of the anal canal (fissure or ulcer), spasm and hypertrophy of the sphincters and levator ani muscles; rectal stricture and neoplasms which may reflexly or mechanically inhibit bowel action. Enlarged prostate or a displaced uterus may obstruct the bowel, while obstructive rectocele or cystocele may result from a

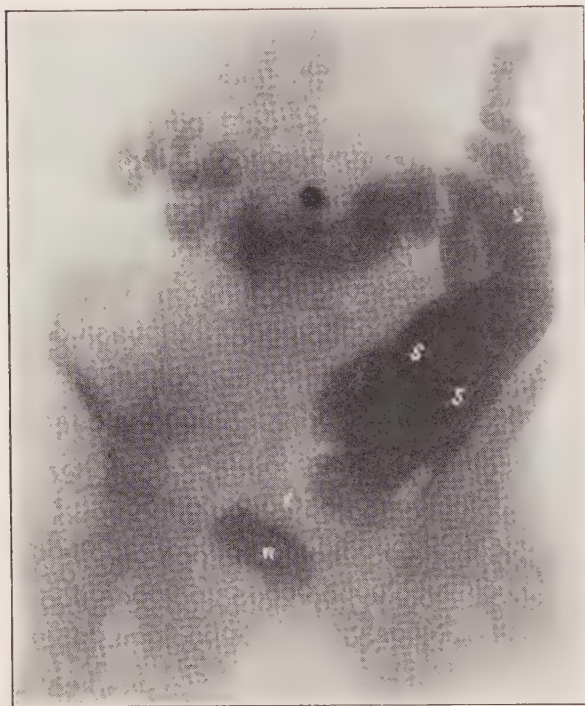


FIG. 110.—ADHESIONS CAUSING CONSTIPATION.

Female, aged forty-two. *H*, hepatic flexure; *S*, sigmoid, long loop; *R*, rectum; *X*, rectosigmoidal angle constricted by adhesions.

lacerated perineum. Proctosigmoidoscopy may reveal a dry, red, atrophic mucosa; a constricted rectosigmoidal angle, or a large angle through which the sigmoid or its mucosa invaginates when the patient presses down. This relatively frequent cause of dyschesia is usually unrecognized unless the possibility of its occurrence is borne in mind. If, to this point, no pathology has been found adequate to explain the condition, analysis of the gastric contents after a test meal should be done; examination of a twenty-four-hour specimen of urine to include the nitrogen and sulphate partitions; a routine stool examination, also an examination of the feces after a Schmidt or Strasburger test diet of three

days; a Wassermann test of the blood, and an x-ray examination of the gastrointestinal tract, to determine points of delay and to differentiate extrinsic abdominal tumors from neoplasms and strictures of the colon proper. Roentgenograms demonstrate enteroptosis, the configuration of the colon and sigmoid, segments of delay (commonly right colon and sigmoid), points of obstruction, and spasm of the colon (spastic constipation). The x-ray examination is completed by a picture of the colon after a barium clysma and a second plate after defecation to determine the function of the lower colon. Fluoroscopic study of the gastrointestinal tract is of far greater value than serial x-ray plates to show points of fixation and to interpret areas of tenderness discovered by abdominal palpation.

In making the diagnosis two points must be borne in mind: First, that progressive constipation is one of the earliest symptoms of carcinoma of the rectum and colon; and second, that the diagnosis of "chronic appendicitis" is frequently fallacious. The appendix may be implicated in the general inflammatory process associated with stasis in the right colon, but unless there is a history of a previous definite acute attack, its removal usually confers no lasting benefit.

Treatment.—This naturally



CURTIS ABDOMINAL SUPPORTER.



CURTIS SUPPORTER APPLIED, FRONT.



BACK.

FIG. 112.—THE CURTIS ABDOMINAL SUPPORT.

Designed in accordance with the suggestions of Sir Arbuthnot Lane, to afford a definite and constant support for the lower abdomen in cases of enteroptosis, visceroptosis and intestinal stasis.

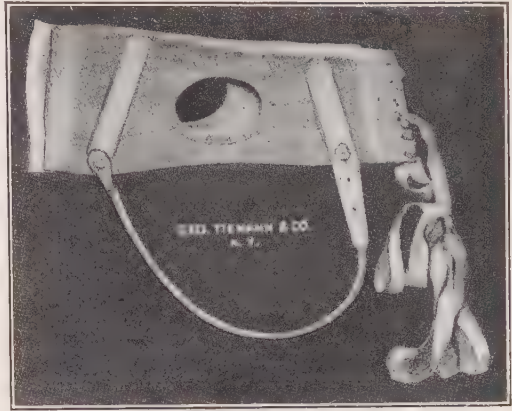


FIG. 111.—EINHORN ELASTIC SUPPORTER.
For flaccid stomach, gastroptosis, etc.

varies with the cause of the constipation or stasis and its type. If enteroptosis is present, and in all atonic cases, a belt or corset, so fitted as to support the lower abdomen, is essential. This elevates the ptosed bowel, relieves strain on its mesentery and increases intra-abdominal pressure. The belt should extend from just above the symphysis to the navel. The patient should adjust the belt while lying down, lacing it most snugly at the bottom. After the abdominal muscles have regained their power of adequate support, the belt may be discarded. Many patients, however, experience so much benefit from wearing the belt that they are loath to part with it. Objection is made to the use of supports on the ground that the abdominal muscles atrophy further from disuse. In actual practice it is found that the rest afforded by the belt gives the muscles opportunity to recuperate.

Exercise.—To be of the greatest benefit, exercise should be taken out of doors. Exercise stimulates the appetite, aids digestion, improves the muscular tone, and increases glandular secretion

and elimination. The best forms of exercise bring all the muscles into play, especially the abdominal muscles. Beneficial exercises are climbing, rowing, swimming, golfing, handball and horseback riding. Exercise should not be carried to the point of fatigue. Exhaustion more than offsets the benefit to be derived from rational exercise. Swedish gymnastics, which can be done indoors, are very valuable in the treatment of constipation. They consist of a variety of movements performed while sitting or standing.

Diet.—A diet balanced for proper nutrition, of adequate quantity and leaving sufficient residue, is important. Correction of the diet is all that is required to relieve many cases of constipation due to deficient motor activity of the intestine or when the feces are too dry. In general, fruit and vegetables that grow above

the ground add bulk and mechanical stimuli by the contained cellulose and chemical stimulation by their sugars and alkaline salts of organic acids. Other stimuli derived from the food are the products of bacterial action on the carbohydrates; the decomposition products of proteins (meat) and neutral fat—fatty acids, soaps and glycerin. In constipation, except the spastic type, bread should be ordered made of whole meal. This includes the bran which contains virtually all of the cellulose of the grain. Bran biscuits are often useful. The fats are very valuable in constipation. Butter and cream are the most easily digestible varieties of fat. Olive oil may be taken alone after meals or with lemon juice as a dressing on salads. Cod-liver oil, plain or in an emulsion, is very beneficial in constipation associated with malnutrition.



FIG. 113.—THE PARIS BELT.

Especially constructed stays strongly imbedded near the lower aspect of the front serve the purpose of a properly formed pad, are resilient and do not show through the clothing.

The oils are valuable in spastic constipation. Fats are good lubricants and moreover increase the flow of bile which is a stimulant to peristalsis. In the intestines, fat-splitting enzymes and bacteria decompose the fats into fatty acids and glycerin which promote intestinal motility. A sufficient quantity of fluid should be drunk and at a proper time. A glass or more of cold water should be taken one half hour before breakfast. This passes out of the empty stomach quickly and is a strong stimulus to peristalsis. Another glass should be taken half an hour before lunch, dinner and before retiring. Hot water, which is soothing, is indicated in spastic cases.

Fermented milk, especially the *B. acidophilus*, is nutritious and, due to the lactic acid it contains, stimulates the bowel. Further, its effect on the intestinal flora renders it particularly valuable in cases of stasis toxemia. Tea, coffee and

cocoa should be limited in quantity. The tannin in these beverages undoubtedly favors constipation. Of course, the diet must be adjusted to the condition of the patient. The fats should not be increased in the obese. Pathologic conditions of the stomach may require a modification of the diet and constipation in diabetics must be regulated by measures other than dietary.

Drugs.—If prophylactic measures, as a regular habit, suitable diet and drinking of water, and proper exercise, were carried out, relatively few cases of chronic constipation would develop. Constant irritation of the intestinal mucosa by cathartics diminishes its excitability. Consequently larger doses must be taken to be effective or another drug tried. In dyschesia, purgatives are positively harmful for they so hasten the passage of food through the intestine that there is not sufficient time for the digestive juices to act upon it and for the absorption of water, salt and nutritive material. Moreover, they clog the distal bowel with undigested residue. Atropin is useful in spastic constipation and mucomembranous colitis by virtue of its paralyzing action on the nerve-endings of the vagus and pelvic nerves in involuntary muscle. Strychnin and nux vomica are of great advantage in atonic constipation. The reflex excitability of the peripheral and the central nervous system is increased. By their action on Auerbach's plexus the muscular coat of the intestine is stimulated.

Vegetable Purgatives.—Vegetable purgatives increase motor activity of the intestines by irritation of the mucosa. Apparently they do not stimulate the secretion of digestive juices. The purgative action of aloes, cascara sagrada and senna is due to certain irritant compounds of anthracene. Cascara acts on both the large and small intestine; senna on the large bowel only. The dose should be so adjusted as to produce a single formed stool every morning. The steapsin of the pancreatic juice splits castor oil into glycerin and ricinoleic acid. The latter and its sodium salt act on both the small and large intestine, its positive effect being mild without griping. Vegetable purgatives do not irritate the stomach.

Saline Purgatives.—MacCallum, Hearst and others have demonstrated that saline purgatives are absorbed from the small intestine and through the circulation act on the neuromuscular mechanism of the colon, increasing motor and secretory activity. Otto has shown experimentally that salts in concentrated solution are retained in the stomach and pass into the duodenum only after they become isotonic with the body fluids by dilution with the gastric secretions. For this reason salts should be administered in a large volume of water and on an empty stomach, preferably a short time before breakfast, as the salts pass out slowly with any food that is present. Insoluble preparations of mercury, *e.g.*, calomel, should not be used constantly as they irritate the intestinal mucosa and may produce mercurial poisoning. Contrary to the former belief, they have no action on the liver in increasing the flow of bile. The green dejecta sometimes seen after taking calomel are now definitely known to be due to the antiseptic action of the calomel preventing decomposition of the bile. Bile salts appear to be the only effective stimulant to hepatic secretion. Ingested fats stimulate the flow of bile from the gall-bladder.

In cases of overdigestion, resulting in too little food residue for efficient defecation, the bulk of the feces may be increased by the addition of substances which do not undergo decomposition or absorption while passing through the intestinal tract. The most useful of such substances are agar-agar and liquid petrolatum (mineral oil).

Agar-agar is prepared from certain Eastern seaweeds. It consists mainly of hemi-cellulose, and a dram absorbs about 3 ounces of water. Thus a teaspoonful of granular agar-agar on cereal or stewed fruit with breakfast and supper materially increase the bulk of feces and acts as a "natural" laxative when the constipation is due to deficient quantity of feces. Mineral oil is not decomposed or absorbed in the intestinal tract; it adds volume, lubricates the mucosa, and softens the feces, and is especially useful in dyschesia. It is best taken in half-ounce doses on an empty stomach, half an hour before breakfast and at night before retiring. Some persons find it disagreeable to take the oil, and in not a few, it passes through without moving the bowels. Seepage of oil through the anus can usually be corrected by reducing the dose. Yeast has been used with considerable success in chronic, non-obstructive cases of constipation. One to three cakes of fresh yeast are ingested daily. Some patients cannot take yeast and it disagrees with others.

Enemas.—Injection of fluids per anum has for its object evacuation of the colon or softening its contents. One and one-half to 3 pints of water, saline or soap solution are administered under low pressure, the container being elevated not over 2 or 3 feet. With patient on his back or either side, the tube is introduced 3 or 4 inches only. When passed further it tends to coil up in the rectum. Fluid so injected will usually reach the cecum. To obtain the full benefit of the enema, fifteen minutes after it has been administered, the patient should sit on a commode where he can take a correct position for efficient defecation, rather than the usual practice of resting on a bed-pan. For ill, weak and elderly patients the bed-pan should be used.

In spastic constipation and colitis, the fluid should be at or slightly above the body-temperature; very high temperatures injure the mucosa. Cold water is not injurious, but if too cold may produce colic. Water at 60° to 70° F. greatly increases peristalsis. Two drams each of water and glycerin act as a powerful stimulus to the defecation reflex. Suppositories containing 1 or 2 drams of anhydrous glycerin act in the same way and are more convenient for the patient. Glycerin should not be used regularly as it tends to lessen the sensibility of the rectal mucosa, nor in cases of hemorrhoids which it irritates.

RECTAL ENEMAS.—Small enemas, 4 to 8 ounces, exert their chief influence on the rectum. Half a pint of cold water injected before breakfast is a tonic to the rectum and a strong stimulus to defecation.

OIL ENEMAS.—Retention enemas of pure olive or cottonseed oil are of the highest value in the treatment of constipation, particularly that of the distal colon and rectum (dyschesia), enlarged sigmoid and when the sigmoid prolapses (invaginates) into the rectum. Five to 10 ounces of oil, warmed to slightly above

the body-temperature, is injected slowly just before retiring, the patient being in the knee-chest position. The retained oil lubricates the bowel, softens the feces, helps to elevate the pelvic colon and the products of its partial digestion later stimulate peristalsis. Usually on rising in the morning or after breakfast a satisfactory stool is obtained. The quantity of oil is gradually diminished, then given on alternate nights and finally used only when the patient feels that the evacuations are insufficient in quantity. When combined with suitable diet and other hygienic measures, no other measure has yielded us such satisfactory results in the restoration of normal physiological action in the class of cases indicated.

Tamponade.—Several of our cases of inveterate atonic constipation and dyschesia, rebellious to other measures, have been relieved by tamponade. The proctoscope is introduced beyond the rectosigmoidal juncture, 3 or 4 ounces of 5 per cent argyrol solution are poured in and forced up the bowel further by light inflation with air. Two or three cotton tampons, each 3 inches long and $\frac{3}{4}$ inch diameter, are now passed in succession into the pelvic colon by long alligator forceps as the tube is gradually withdrawn. The return flow of the solution swells the tampons, thereby acting as a splint in straightening out the rectosigmoidal angulation, and by distention stimulates peristalsis. The solution exerts a marked beneficial effect on the mucosa, if inflamed, as it often is. Treatments are repeated three times weekly, then at longer intervals as the condition improves.

External Hydrotherapy.—Water may be applied to the abdomen as douches or compresses. Cold water seems to stimulate reflexly the musculature of the intestine, while heat has a sedative effect as noted in spastic constipation. Water is also used as an alternating hot and cold spray, as a plunge or sitz-bath.

Massage.—Massage exerts a stimulating effect on the intestinal musculature but has only slight propulsive action on the intestinal contents. Massage is excellent for weakness of the abdominal wall. Its chief value in dyschesia is in strengthening the abdominal muscles. Its use is contra-indicated when inflammatory complications are present, and it aggravates spastic constipation. The production of pain during the treatment indicates that the manipulations are too strenuous or that the condition is not suitable for massage. Massage by a skilled masseur is most efficient, although some patients learn to massage themselves quite satisfactorily. The best time for the treatment is before breakfast; at first daily, later on alternate days.

Vibration.—Vibration over the abdomen strengthens the propulsive power of the large bowel. The vibrators may be applied over the spinal cord centers for their sedative, inhibitory or stimulative effects. Other vibratory machines employed in chronic constipation are the Zander horse, abdominal roller and the vibrato-masseur.

Electricity.—There is very little knowledge of positive value regarding the effects on the intestine of various forms of electricity. Other forms of treatment are usually successful but its psychologic and other effects seem to be

beneficial in constipation developing in neurasthenics. In general, electricity is of very limited value in the treatment of constipation. Faradism has a minor effect and mainly on the small intestine. Galvanism is used quite extensively in conjunction with other measures for constipation due to weakness of the intestinal musculature. The cathode is placed on the back and the anode is moved slowly along the colon from the cecum. Treatments are given daily for fifteen minutes or less frequently.

Static Electricity.—Spark, bath, breeze and friction are of assistance in restoring the system in constipation developing in neurasthenic persons. Sinusoidal electricity has a general tonic action and relieves flatulence, pain, soreness and enterospasm.

In this general but brief review of the hygiene, diet and therapeutics of chronic constipation, the reason for and purpose of each measure has been indicated. Reestablishment of normal physiology through hygiene and diet is attainable in the majority of cases, aided at first by agar-agar and mineral oil. Uncomplicated cases of rectosigmoidal constipation (dyschesia) are best managed by retention oil enemas, diet, exercise, massage and a supporting belt. Analysis shows that this is the most common form of constipation and the constant use of strong cathartics does harm. They hurry the contents of the small and large intestine so quickly that there is not sufficient time for proper digestion of the food and absorption of its nutritive material.

When toxemia is present, fermented milk may with advantage be substituted for meat or added to the diet. Pasteurized milk, fermented by the *B. acidophilus* or *B. bulgaricus* is usually employed. Acidophilus milk is quite palatable and preferable. The bacilli tend to inhibit the normal intestinal flora and when the milk is drunk regularly for a considerable period, three weeks or longer, *B. acidophilus* largely supplants the usual intestinal bacteria, but the latter return quickly once the ingestion of the *B. acidophilus* is stopped. Three or four glasses of the milk should be taken daily. Some authorities report success in the treatment of the so-called infected colon, with toxemia as the dominant symptom, by hypodermic injection of autogenous or other vaccines. Intestinal antiseptics, as salol and calcreose with iodine, given one hour after meals, appear to have an inhibiting effect on the intestinal flora and to be beneficial in these toxic cases.

Spastic constipation is in a class of its own as regards treatment. The depressed state of the nervous system requires treatment and the physician must encourage the patient and assure him that he will recover. Complete mental and physical rest in bed may be required for a time in very severe cases. A mixed diet, from which irritating substances are excluded, is advised. Fluids for drinking should be hot. Cathartic drugs increase the pain and may not open the bowels unless combined with antispasmodics. The most used of these are belladonna by mouth or atropin by needle. Morphin should not be employed lest a drug habit be formed, but codein in $\frac{1}{2}$ grain doses, may be combined with extract of belladonna, $\frac{1}{4}$ to $\frac{1}{2}$ grain. When anal spasm is present, relief is

obtained by a hot sitz-bath, a belladonna suppository or by passing rectal bougies, in increasing sizes on succeeding days. Castor oil is a useful purgative, but bowel evacuations are best obtained by warm enemas, administered under low pressure, and by retention enemas of warm olive oil injected at night. Hot baths and hot applications to the abdomen frequently counteract the spasmodic pain. Usually massage and electricity are contra-indicated.

Surgical Treatment.—Many internists hold the ultraconservative view that all cases of stasis toxemia are treated best by non-surgical measures. On the other hand, surgeons have practiced either conservative or radical operations, with the recent tendency toward conservatism. In the presence of these divergent views this question is pertinent: Is there a surgery for chronic intestinal stasis and, if so, what is its indication? The answer is affirmative and, to my mind, the sole clear indication is intestinal obstruction, either mechanical or physiological. This does not refer to organic occlusion of the bowel, as by stricture, but includes all lesions that interfere with normal physiology. This view may be elucidated by a brief review of the lesions amenable to conservative surgery and comment on the more radical measures.

Anal fissure or irritable rectal ulcer, when neglected, produces a hypertrophied, spasmodic sphincter muscle which becomes obstructive, and is responsible for many cases of stasis toxemia and "nervousness," especially in women. Excision of the fissure and superficial division of the sphincter muscle under local anesthesia assures a cure and is the acme of conservative surgery.

Houston's valves are constant anatomic folds of the rectal mucosa. Some authors have emphasized their obstructive rôle. Only in very exceptional cases do they undergo a change into obstructive fibrous membranes. The resistance of the valves is determined by dragging down on their free margin by a hook bent at a right angle and passed through an endoscope. An obstructive valve may be divided, in from seven to ten days, by a spring-clip, applied through a proctoscope. Irritation produced by the clip excites bowel action until it sloughs away, but usually no permanent benefit ensues and valvotomy is practically obsolete.

The sigmoid colon is a zone of segmental delay of prime importance which is all too frequently neglected. No other portion of the colon is so frequently involved in obstipation. Two conditions are responsible: one anatomic, the other pathologic. The tube can be passed into the sigmoid in about 75 per cent of cases. A spacious rectosigmoidal angle and prolapse of the bowel into the tube when the patient "bears down" suggest that the sigmoid is atonic or dilated and probably exceeds the average length of 18 inches. The tube introduced into the sigmoid is swayed gently from side to side to determine the mobility of the bowel. Traction on adhesions causes pain, limits the excursions of the tube and suggests the probable presence of bands or adhesions which interfere with peristalsis and elevation of the sigmoid from the pelvis during defecation. Correct interpretation of sigmoidoscopic findings, especially when confirmed by x-ray study, is invaluable in determining the location and cause of many

cases of stasis. For many years the author has employed retention enemas of warm olive oil in uncomplicated cases of prolapsing redundant sigmoid. When used in conjunction with suitable diet, exercise and a supporting abdominal belt, the results in a large series of cases have been most satisfactory in restoring normal physiology. Other cases, however, notably those fixed by adhesions, do not respond to palliative treatment. Further, the redundant sigmoid may twist on itself, producing acute or chronic recurrent volvulus, with symptoms of intestinal obstruction.

Intermittent chronic, and rarely an acute obstruction, results from invagination of the sigmoid into the rectum. Surgery is required for many of these cases, typical operations being sigmoidopexy, mesopexy, lateral anastomosis of the two limbs of the sigmoid, and resection of the redundant bowel as in Hirschsprung's disease.

When bands fix the sigmoid in an abnormal position, they must be divided through an abdominal incision; pathologic adhesions separated and the raw surfaces inverted by suture.

Case.—Mrs. K., aged twenty-seven, had severe headache, intestinal colic and constipation of many years standing, relieved only temporarily by drastic cathartics and enemas. Examination showed tenderness over right lower quadrant of the abdomen and an exquisitely tender mass, the size of an English walnut, in the right vaginal fornix. Laparotomy revealed a long sigmoid adherent to the fundus uteri and right adnexa. The adhesions were separated and the appendix removed with prompt and permanent relief of all symptoms, now a period of over ten years.

As already indicated, *peritoneal bands*, constricting and obstructing various segments of bowel, occur quite regularly in certain situations, as Jackson's membrane, Lane's kink, etc. Moreover, other bands and omental adhesions may be encountered in most unexpected places. They usually result from inflammatory conditions within the abdomen or follow intra-abdominal operations. T. C., a youth aged nineteen, had pain in the lower abdomen, attacks of nausea and vomiting, constipation and toxic symptoms for several months. I operated upon a very small right inguinal hernia in the sac of which the omentum was found adherent. Division of the omentum and repair of the hernia resulted in a cure.

General enteroptosis or Glenard's disease, in which most or all of the viscera are prolapsed, is readily recognized and stasis toxemia may be present or not. Displacement and distortion of the viscera, *per se*, as shown by the x-ray configuration, may not be of vital import, provided the organs have adjusted themselves to their abnormal relations and are working in harmony. Abdominal supports and forced feeding, especially if the body weight can thus be increased, will benefit the majority of these enteroptotics. Surgery, however, is required for others, in particular when certain segments only of the gastro-intestinal tract are ptosed and obstructive. In general, the fixation of organs normally free, as is the intestine, violates the principle of not hampering normal physiology. However, the result obtained justifies the fixation in carefully selected

cases. For example, the elongated transverse colon, prolapsed into the pelvis and especially if adherent there, may sharpen the angulation at the splenic flexure to an obstructive degree. It is restored to normal position, and often to normal function, by the hammock operation of Coffey, whereby the gastrocolic omentum is shortened and the colon attached in normal position to the anterior abdominal wall by a row of linen sutures.

A striking instance of the benefit sometimes accruing from this operation is the case of Mrs. S., a frail woman, aged thirty-seven, operated upon in 1916 at the Polyclinic Hospital. Three years previously her appendix had been removed without relief from attacks, similar to the present, which had occurred at intervals for eleven years. The last attack, of nine weeks' duration, was marked by anorexia, nausea and vomiting, severe constipation and prostration that confined her to bed. Convalescence from the operation was uneventful. She now eats ordinary food, has neither dyspepsia nor constipation, and does the usual work of her home. At the time of operation her weight was 83 pounds; now it is 99, the highest it has ever been. In this type of case with delay in the transverse colon due to angulation at the splenic flexure, Mummery has joined the transverse colon to the sigmoid flexure by a side-to-side anastomosis and reports very gratifying results in several cases.

The major surgical measures for chronic enterostasis are comprised under two heads: (*a*) Short-circuiting operations, ileosigmoidostomy (abandoned), cecosigmoidostomy (rarely applicable), colosigmoidostomy (Mummery), and (*b*) colectomy, partial (right-sided) or complete. Short-circuiting is effective in a certain few selected cases. Colectomy is rightly waning in popularity by reason of the risk involved, even in experienced hands, and now is rarely performed by conservative surgeons except in unusual cases where the colon is converted into a useless toxic sac as a result of chronic pathologic changes.

Stasis in the cecum, ceco-colon and terminal ileum may account for the severest forms of toxemia, but their detailed discussion is outside the limits of this work.

In summary, the surgery of chronic intestinal stasis, with or without toxemia, cannot be standardized. Each case must be studied individually. Conservative surgery will usually relieve cases due to mechanical obstruction. Short-circuiting operations have a definite but limited application. Colectomy, either partial or total, has an operative mortality of over 16 per cent, and, even when survived, fails to relieve the symptoms in a large proportion of cases. The results do not justify colectomy, cecectomy or sigmoidectomy for stasis toxemia.

Bloodgood made the important observation that after successful resection of the colon for neoplasms there is quick restoration of bowel function. This is in striking contrast to the removal of segments for chronic stasis. In many cases, although constipation is relieved, the toxemia persists. Naturally this should be true, for after the bowel has been long subjected to stasis toxemia, profound tissue changes are wrought in the organism as a whole, and marked general toxemia is present. In these cases, operation is only the first step in the rehabil-

itation of the patient. The physician must keep these patients under observation and direct their hygiene, diet and mode of life, with the object of relieving the toxemia which has been years in developing; otherwise the patient will not derive the full benefit of his operation, and even conservative surgery, when properly performed in carefully selected cases, will be discredited.

FECAL IMPACTION

Impaction is the arrest of a fecal mass in some portion of the intestinal canal. The most common sites of arrest are the rectum and sigmoid, and rarely the cecum. Diverticula of the intestine may also become impacted with feces. In certain pathological conditions, impaction gives rise to the chief symptoms. This is notably true in Hirschsprung's disease, and occlusion of the bowel by organic stricture and neoplasms. In senile constipation the colon may be im-

acted over a large area. It is prone to occur in constipated subjects and the same causes operate to produce it. Foreign bodies in the intestinal canal, as fruit pits and enteroliths, and in children, a mass of worms are causal. The fecal mass is hard and sticky or of doughy consistency, and ordinarily contains an excess of lime salts. Usually the mass is made up of small scybala compressed together, its quantity in some cases being enormous, 8 pounds or more.

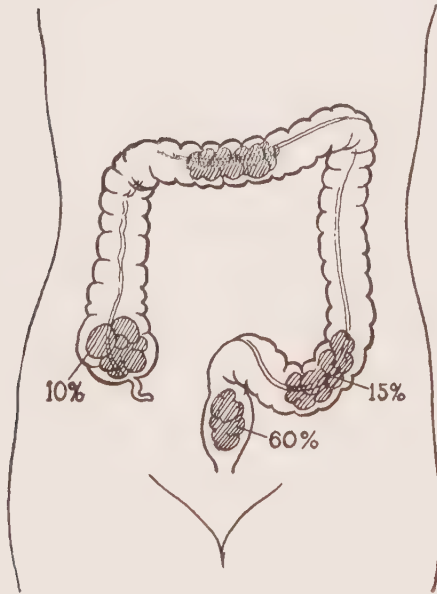


FIG. 114.—SITES OF OCCURRENCE OF FECAL IMPACTION.

Symptoms.—Usually the symptoms are those of constipation, or the sudden stoppage of fecal movements, followed in a short time by griping and heaviness in the region of the impaction. The arrested mass irritates the mucosa so that liquid stools may be passed around the mass, containing some mucus and at times blood. The symptoms naturally

vary with the site of impaction. When in the rectum, there is a feeling of weight and pressure in the pelvis, and when standing, a constant desire to go to stool, which defecation does not relieve. Pain and spasm about the anus and frequent or difficult urination may be complained of.

Impaction may exist for an indefinite period before its real nature is discovered, from several months to as long as three years.

Diagnosis.—When the impaction is in the rectum or sigmoid flexure, the diagnosis is made by feeling the mass with the finger or seeing it through the

proctoscope. When the mass is in the upper colon, diagnosis may be very difficult. In this situation, the accumulation has been mistaken for an intestinal neoplasm, a tumor of the stomach, liver, spleen or uterus. If the abdominal wall is thin, the doughy consistency of the mass may at times be made out. Discovery of several masses in the left lower quadrant is a rather common occurrence in obstructive carcinoma of the sigmoid and may obscure the diagnosis. Roentgenograms are valuable in differentiating impaction from tumors of the bowel and from extrinsic growths.

Treatment.—Cathartics have limited use in impaction. Drastic cathartics irritate the mucosa and further stimulate peristalsis and spasm already exaggerated by the accumulation. This may traumatize the bowel wall by pressure against the mass or even cause its rupture; or may force the hardened feces



FIG. 115.—KELSEY'S RECTAL SCOOP.

into the constricted lumen of the gut beyond, thereby producing complete obstruction, with its train of symptoms.

The most rational treatment is by rectal injections. Injections of a few ounces of warm water at frequent intervals tend to soften the feces. The most effective solution is 25 per cent peroxid of hydrogen which exerts a rapidly solvent action on the mass, which can then be expelled voluntarily. If the mass is not softened and does not move after trial of the injections for twenty-four hours, mechanical measures should be undertaken for its evacuation. A mass retained in the rectal ampulla for a long time frequently becomes globular, hard and smooth like a baseball. Small masses in the rectum can sometimes be expressed in men by making pressure just below the tip of the coccyx which converts the ampulla into an inclined plane; and in women, two fingers introduced into the vagina may force the mass out or steady it while it is being broken up by the finger. If these measures fail in rectal impaction, the patient should be placed under general anesthesia and the sphincters dilated. The mass may then be expelled spontaneously. If not, it is broken up with the gloved fingers, a stream of warm water, introduced through a tube passed alongside the fingers, washing out the feces as they are disintegrated. Metallic scoops and spoons and curets are a poor substitute for the fingers in breaking up the mass and may cause serious injury to the bowel wall. When impaction is in the sigmoid colon, irrigations and abdominal massage are indicated. After emptying the rectum, the masses in the sigmoid may sometimes be moved downward into the rectum by abdominal pressure. In three obstinate cases of sigmoidal impaction, Tuttle injected ox-gall, glycerin and water, and twenty-four hours later introduced the pneumatic sigmoidoscope, distended the sigmoid flexure with air, thus elevating it into the abdominal cavity, and dislodged the mass. When impaction occurs above a stricture, excessive manipulation from below should be avoided,

as under such circumstances, the bowel may be ruptured. The wisest and safest course under these conditions is to perform a colostomy.

Once impaction has been relieved, regular bowel action must be maintained lest the condition recur.

REFERENCES

CONSTIPATION

- CRÄMER, F. *Darmatonie*, München, 1906.
- HARVEY, S. C. "Congenital Variations in the Peritoneal Relations of the Ascending Colon, Cecum, Appendix and Terminal Ileum," *Ann. Surg.*, June, 1918, p. 461.
- HERTZ (HEARST), Arthur F. *Constipation*, Oxford University Press, 1909.
- HEWLETT, A. W. *Pathological Physiology of Internal Diseases*, New York, D. Appleton & Co., 1923.
- LANE, Sir W. Arbuthnot. *The Practitioner*, London, May, 1922.
- *Operative Treatment of Chronic Intestinal Stasis*, Oxford University Press, 1918.
- TAYLOR, A. S. "Anomalous Abdominal Membranes," *Ann. Surg.*, May, 1922, 75: 513-573.

CHAPTER VI

HEMORRHOIDS

Hemorrhoids are estimated to comprise about 30 per cent of rectal ailments. It is probable that very few people, in the course of life, are unaffected to some degree by the condition. Of all the affections of the rectum, hemorrhoids are of the greatest historic interest. The Old Testament refers to them as "emrods" or the plague. They have received the continued attention of medical writers from Hippocrates to the present, and the end is not yet. Their etiology and pathology were not understood by the early writers but the symptoms were described.

Hemorrhoid is derived from the two Greek words *αἷμα* (blood) and *ρεῖν* (to flow). Strictly speaking this is a term description of a symptom and does not define the disease. However, by common consent the word hemorrhoids refers to varicose swellings of the lower rectum and anus. Piles, from the Latin *pila* (a ball or swelling), defines the condition much more accurately and is generally used by the laity. Unfortunately the laity considers nearly every rectal affection to be piles—"itching," "blind," "bleeding," etc. In this chapter the two terms will be used synonymously.

Definition.—Hemorrhoids are varicose tumors involving the radicals of one or more hemorrhoidal veins, characterized by hemorrhage or prolapse; tending to interstitial fibrosis and spontaneous cure, or thrombosis and ulceration.

Classification.—A working classification of hemorrhoids is external, internal and mixed, or combined externo-internal. Internal hemorrhoids are derived from the radicles of the superior hemorrhoidal vein, are situated in the rectum above the mucocutaneous line and are covered with mucosa. External hemorrhoids originate in the inferior hemorrhoidal vein below the mucocutaneous line and have a cutaneous covering. Mixed hemorrhoids are a combination of the two other varieties in the same individual. This simple classification is practical for both diagnosis and treatment, and is not affected by the pathologic changes that may occur in the involved veins.

EXTERNAL HEMORRHOIDS

This variety of piles may be either cutaneous or thrombotic.

Thrombotic External Hemorrhoids.—They result from a strain or traumatism of the engorged external hemorrhoidal veins. Exceptionally the clot may form in a radicle of the varicose vein but usually the vein ruptures and the blood accumulates as a single large clot; as several clots, each the size

of a pea; or as many smaller ones infiltrating the connective tissue. Considerable discussion, mostly speculative, has been indulged in, respecting the situation of the blood-clots. Histologic study shows that in a small minority of cases clotting occurs within the vessel; in some cases only the intima and media are ruptured and the adventitia of the vein forms the limiting wall of the clot. In the vast majority of cases, however, all coats of the vessel are ruptured and clotting occurs in the connective tissue external to the vein. The exciting cause is always a strain, as lifting heavy weights, effort at stool, violent exercise and



FIG. 116.—PHOTOMICROGRAPH OF THROMBOTIC EXTERNAL HEMORRHOID.
Veins distended with blood-clots.

coughing or sneezing. Usually the patient has a feeling that something has given way. Immediately there is a sense of local swelling and discomfort which, in a few hours, becomes a severe, constant pain, often throbbing in character, and aggravated by sitting, pressure or bowel action. The pain is due to the tension and pressure of the clot on the numerous sensory nerve-endings in the perianal skin and is much aggravated when the sphincter is tight and spasmodic. After forty-eight hours, the pain usually subsides to a marked degree.

Diagnosis.—Examination usually discloses beneath the smooth, shiny skin, at one side of the anal verge, an ovoid, livid, firm, tender swelling, the size of a grape or smaller. Scarcely any internal swelling is present but rarely a bluish,

tender ridge is felt, extending upward beneath the mucocutaneous lining of the anal canal. At other times marked edema may obscure the clot which may nevertheless be felt by deep, firm compression between the thumb and index finger.

With palliative treatment the course varies with the size and location of the clot. In the case of a small clot, resolution may occur in ten days to a fortnight,

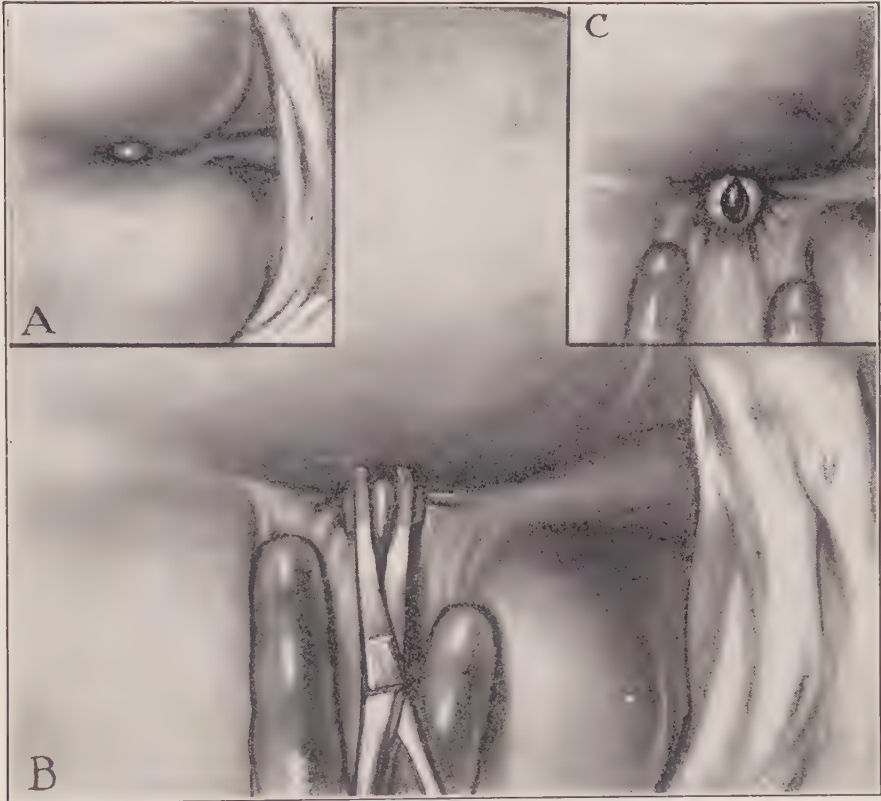


FIG. 117.—EXTERNAL THROMBOTIC HEMORRHOIDS.

A, the thrombosed pile. *B*, method of excising an ellipse of overlying skin by a single clip of scissors curved on the flat. *C*, clot protruding through the incision.

but usually a shotlike, irritating residue persists beneath the skin, or there results from the irritation of the extravasated blood a local production of subcutaneous connective tissue. In fact, this is the usual method of formation of perianal skin tabs, *i.e.*, *cutaneous* piles. When the clot is large, and especially if it extends up beneath the anal lining, pressure necrosis frequently occurs, followed by bleeding. The clot may be retained or expelled. Infection may follow and an ulcer or superficial fistula result. Rarely infection of the blood-clots produces a marginal abscess.

Treatment.—**PALLIATIVE.**—Palliative treatment consists of rest in bed, saline or other mild laxatives to secure regular bowel action, and local applications to reduce the swelling and aid absorption. Cleanliness of the parts to avoid infection is important. Hot sitz-baths twice daily allay the pain. The most efficient local application is compresses of lead and opium wash applied continuously. Compresses of magnesium sulphate or boric acid, hot or cold, may be used. Ointments are usually of little or no benefit, and suppositories are quite useless. Gentle dilatation of a tight sphincter with the finger may afford considerable relief. Some cases respond favorably to palliative measures, resolution

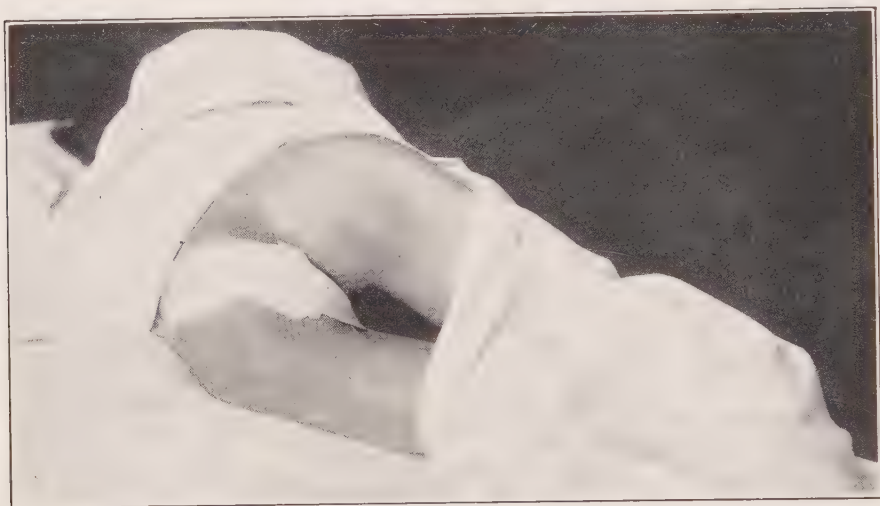


FIG. 118.—EXTERNAL THROMBOTIC HEMORRHOIDS.

Method of applying long strips of adhesive to obtain pressure and prevent bleeding after operation.

occurring, or a shotlike subcutaneous induration or skin tab only remaining. Other cases are not relieved and new clots may form. In view of the usually prolonged treatment necessary, the suffering entailed and uncertain outcome, palliation, except in trifling cases, is but a poor substitute for operative treatment.

OPERATIVE.—Operative treatment eliminates the trouble at once, cuts short the pain and period of disability.

Procedure.—Without any preliminary preparation, the patient lies on the table in the Sims' position, right or left, the affected side being downward, which greatly facilitates the operation. The skin is cleansed and any long hairs are cut away with scissors. Tincture of iodine or 5 per cent solution of picric acid in alcohol is swabbed over the swelling. A 25 gauge, sharp needle attached to an all-glass syringe, charged with 2 per cent novocain, is introduced at the outer limit of the swelling and, as it is gently advanced, an intradermal wheal is produced which spreads over the entire surface of the mass. Only 1 or 2 c.c. of the anesthetic solution are required. Then, with a sharp pair of long shanked,

slender curved scissors, an ellipse of skin is excised by a single, clean cut, extending from the outer to the inner margin of the thrombus. The clot usually delivers itself spontaneously but, if retained by its connective-tissue envelope, the scissors are insinuated on each side, snipping slightly if necessary, till it is freed and evacuated intact. Neither the finger nor any instrument, other than the sterile scissors, enters the wound lest it be infected. A sterile compress, applied firmly to the wound for a few minutes, controls the slight bleeding, and the wound margins close in accurate apposition. Aristol on a small compress is now applied to the wound and held firmly in place by a 15-inch strip of adhesive tape 1 inch broad, running from the inner side of the thigh, close to the anus and upward over the buttock to the loin (Fig. 118). The operation is painless. Some patients have no pain subsequently, while others experience a smarting or burning sensation for an hour or two after the anesthetic wears off. The bowels are confined for twenty-four hours. Then the dressing is removed and the wound cleansed after each bowel action by sponging with hot water and absorbent cotton. After drying, a small pledget of cotton dusted with aristol powder is left *in situ*. No bandage is required. If this technic is carried out in detail, primary healing of the wound usually occurs. There is no detention from business, or at most a single day, and in a week the scar is barely visible. In my experience this method of treatment is far superior to the procedures usually advocated of incising the skin over the swelling, turning out the clot and packing the cavity with gauze or suturing the margins of the wound.

INTERNAL HEMORRHOIDS

Internal hemorrhoids are vascular tumors situated in the lower rectum just above the anorectal line. As a direct result of the normal distribution of the superior hemorrhoidal veins, the situation of internal hemorrhoids is constant, *i.e.*, in one of four quadrants. If the anus be divided by two lines, one mesial, the other transverse, intersecting at right angles at its center, four quadrants are formed. In a typical case a hemorrhoid is present in at least three of these quadrants, commonly the two posterior and right anterior. Frequently, there is a fourth in the left anterior quadrant and occasionally one centrally posterior. Less frequently but two hemorrhoids are present and rarely only one. In a typical case the pile is of bluish color and consists of conglomerate, dilated radicles of the superior hemorrhoidal vein, united by connective tissue and covered with rectal mucosa.

Occurrence.—*Age.*—Internal hemorrhoids develop most frequently between the twentieth and fiftieth years of life; that is, during the period of greatest physical and mental activity. A considerable proportion of cases occur in later life, but comparatively few in children or those under twenty years of age. The youngest patient in my experience was an infant of two years, who had well-developed internal hemorrhoids which bled quite freely. An operation with the clamp and cautery ended the trouble. A number of cases of internal

hemorrhoids in young children is reported in the literature. In cases of bleeding from the rectum, the possibility of hemorrhoids being causal must be always considered, but it will usually be discovered that, in children, the hemorrhage is from another source, commonly a polypus, prolapse of the mucosa or a third degree prolapse of the rectum.

Sex.—Statistics from a large series of cases indicate that, of the patients applying for treatment, males outnumber females approximately two to one. Probably this does not represent the true incidence of the disease in the sexes. The appearance of blood is unusual and alarming to men; while women, accustomed to the menstrual flow and due to innate repugnance to examination, often pass over lightly a “show” of blood. This is unfortunate, as it may be evidence of a more serious condition and no treatment should be prescribed until the source of bleeding has been determined by examination.

Etiology.—The causes of internal hemorrhoids fall under two chief categories:

Predisposing

Heredity

Senility

Anatomical

Exciting

Physiological

Mechanical

Predisposing Causes.—**HEREDITY.**—The rôle of heredity in the etiology is doubtless of greater importance than is generally assigned to it. This does not mean that hemorrhoids are inherited directly any more than to say that tuberculosis is thus transmitted. Close questioning will frequently elicit from a patient that brothers or sisters, parents and grandparents suffered from hemorrhoidal disease. Varix, with or without hemorrhoids, may have manifested itself in other forms, as varicocele, varicose veins of the legs, or ruptured esophageal veins. Thus the history and physical findings substantiate the claim of an inherited structural weakness of the venous system in many cases. Under the physical and mental strain of the active years of life—third to fifth decades—the structurally weak veins naturally give way. Hypertension, usually acquired during this period, is a contributing factor.

SENILITY.—Hemorrhoids acquired in later life are often an accompaniment of senescence and are part and parcel of a degenerative change affecting all the tissues of the body. The sphincters are thin and atonic and adequate muscular support is lacking.

ANATOMICAL.—The basic anatomical fact in the etiology of hemorrhoids is that the veins from the hemorrhoidal zone drain, through the superior hemorrhoidal, directly into the portal vein which has no valves. Quadripeds seldom develop a hemorrhoidal condition. The upright posture is peculiar to man, who spends two-thirds of his life in this position. As a result, a column of blood, unsupported by valves, from the liver to the anus, exerts back pressure at its most dependent point, namely, in the radicles of the superior hemorrhoidal vein. This is not exactly analogous to a column of fluid of uniform thickness, be-

cause the venous column is subdivided more and more as it approaches the anus. Physiological and other factors play such a large part in the onward propulsion of the blood stream that it is quite probable that the absence of valves in the veins has been overstressed in the etiology.

Another important anatomic fact is the loose connection in the hemorrhoidal zone of the rectal mucosa to the muscularis. The submucous areolar tissue, in which the venous radicles ramify, allows, at this point, much freer separation of the mucosa from the muscular coat of the bowel than elsewhere. Verneuil emphasizes the obstruction offered by the muscular coat of the bowel where the branches, forming the superior hemorrhoidal veins, perforate it.

Exciting Causes.—PHYSIOLOGICAL.

—Any condition which tends to engorge the portal and hemorrhoidal veins is causal. Among these are a congested liver, as in uncompensated heart disease, and cirrhosis and neoplasms of the liver. Overeating, especially of highly seasoned foods to which irritating condiments are added, increases congestion. The question of food adjustment is largely the old one: Live to eat or eat to live. The food requirements of the physically active person is greater than for the sedentary. Consequently overeating by the latter distends the bowel and engorges the portal system. Alcoholic beverages in excess likewise congest the liver and often acute hemorrhoids develop promptly after a debauch. Colitis patients may develop hemorrhoids from the irritating discharges but this does not occur as often as one would expect. Cathartics, especially the resinous variety, which act by direct stimulation and irritation of the mucosa, frequently produce hemorrhoids.

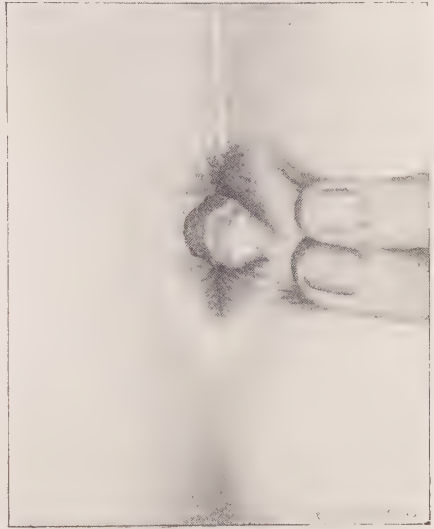


FIG. 119.—MIXED HEMORRHOID:

INCREASED INTRA-ABDOMINAL PRESSURE.—Constipation acts as a two-edged sword. Straining at stool increases the intra-abdominal pressure and direct pressure of the hardened feces is against the direction of the venous current. Habitual constipation is the most common exciting cause of hemorrhoids. Other factors increasing intra-abdominal pressure are: The straining incident to urethral stricture; hypertrophy of the prostate; chronic cough, and horseback riding.

MECHANICAL.—Mechanical causes are *intrinsic*, as stricture or tumors of the rectum, especially of its upper portion, in which the importance of the primary condition overshadows the hemorrhoids, and *extrinsic*, as abdominal and pelvic tumors, pregnancy, childbirth and retroversion of the uterus.

Pathology.—Grossly, internal hemorrhoids appear as longitudinal folds of mucosa within the rectum, beginning at the pectinate line or true mucosa and extending upward a distance varying from 2 to 4 centimeters, where they flatten out and blend into the rectal mucosa. The hemorrhoid encroaches on the bowel lumen and the straining effort of passing hard fecal masses exerts traction on the mucosa which is thus protruded. Should the prolapsed hemorrhoid be grasped by a spasmodic sphincter and not replaced, strangulation may ensue. Superficial gangrene often follows strangulation. Rarely, infection and abscess formation occur.

A typical hemorrhoid consists of a conglomerate mass of dilated venules, a few unchanged arterioles, a connective-tissue stroma which shows chronic inflammatory changes, and a covering of rectal mucosa, more or less diseased. Portal congestion and increased intra-abdominal pressure produce an abnormally high blood-pressure in the venous radicles, which causes them to dilate. Fecal traumatism injures and often ruptures the vessels. Histologic study shows that the muscular and elastic tissue in the vessel wall is replaced, to varying degrees, by fibrous tissue. The final product is a vessel, the thin wall of which is made up largely of fibrous tissue with an endothelial lining, very vulnerable and prone to rupture. Rupture is usually due to fecal trauma but may result from extension of ulceration from the mucosa. Occasionally circumscribed thrombosis occurs in the diseased veins under the same conditions as produce it in varicose veins in other situations. The arterioles undergo no important histologic changes. The interstitial connective tissue shows inflammatory changes of a chronic, productive character, due to chronic congestion, irritation by blood extravasated from the veins, and infection through the ulcerated mucosa. In its contraction, the fibrous tissue thus formed tends to obliterate the venules and so produce a spontaneous cure of the hemorrhoid, or to transform it into a fibrous mass. The mucosa, in chronic cases, may be intact and thickened. More usually it shows degenerative changes and is thinner than normal and its surface granular. Traumatism of the mucosa by hard feces causes abrasions and fissures, which are infected by the omnipresent bacterial flora of the intestine, resulting in erosions and ulcers.

Degenerative Changes in Hemorrhoids.—Occasionally internal hemorrhoids of long standing undergo degenerative changes of a simple or malignant nature. Probably as a result of thrombosis of the veins, the hemorrhoid may be converted into a fibrous mass (a fibroma) which, due to its frequent extrusion by the bowel, becomes elongated into a fibrous polypus. One instance of carcinoma, developing on an internal hemorrhoid, has come under my observation. Prolonged local irritation would seem to be the most plausible explanation of this malignant degeneration.

Symptoms and Signs.—*Bleeding.*—Bleeding and protrusion are the characteristic symptoms of uncomplicated internal hemorrhoids. The congested mucous membrane covering the pile soon becomes granular and vulnerable, so that bleeding is commonly the first symptom observed. The blood, of red color,



1. THROMBOTIC HÆMORRHOIDS



2. INFLAMED HÆMORRHOIDS WITH EROSION



3. INTERNAL HÆMORRHOIDS
WITH ŒDEMA OF ANAL MARGIN



4. PROLAPSING INTERNAL HÆMORRHOIDS

TYPES OF HEMORRHOIDS.

accompanies the stool and is usually of less quantity than the patient estimates, or it may be admixed with the stool and escape notice. Exceptionally at defecation a stream of blood will spurt from an ulcerated vein, resulting in a massive hemorrhage. Hemorrhoids, constantly prolapsed, frequently stain the clothing with blood. It is estimated that hemorrhoids bleed at some time in their course in 85 per cent of cases.

Regular loss of blood with the stools, like the constant dropping of water that wears the stone, exerts a cumulative effect. Secondary anemia develops to varying degrees. A red blood-cell count under 4,000,000 and hemoglobin below 70 per cent is found quite regularly. In extreme cases I have seen the hemoglobin as low as 30 per cent. Pallor, weakness, vertigo and palpitation may divert the physician from the real trouble and suggest a primary anemia. Under these conditions, operation can be safely performed under local anesthesia, but a preliminary blood transfusion is very desirable.

"Concealed hemorrhage" occurs in some cases. The blood accumulates in the rectum and is evacuated as large tarry clots, together with or independent of the stools. Accumulation of blood in the bowel excites colicky pains and a desire to expel the dark clots. Under these circumstances there is presented a nice question of diagnosis between hemorrhoids and malignant disease. Occasional bleeding from hemorrhoids in cases of cirrhosis of the liver may be salutary, in that it relieves a surcharged portal system. No effort to check this type of bleeding is indicated unless the blood loss results in an anemia.

Protrusion.—This is usually a late symptom of internal hemorrhoids. As a result of trauma and infection, many cases of hemorrhoids undergo varying degrees of fibrous change, obliterating the vessels in part. As a consequence, bleeding, which was the chief feature at the onset, may be slight or absent when the protrusion has developed. Protrusion may be absent or be the chief complaint. At first the protrusion is generally slight, occurs only at stool and is reduced spontaneously. Later, the protrusion, grasped by the sphincter, must be replaced by the hand. Recurrent protrusion tends to dilate and relax the sphincters, so that protrusion occurs with the slightest effort, even walking, and the hemorrhoids are virtually always extruded except when the patient reclines.

The chronically protruded mucosa becomes irritated and is prone to abrasion and superficial ulceration. The mucus and other discharges soil the linen, and cause local moisture and irritation of the perianal skin, so that pruritus is frequently complained of.

In cases with tonic sphincters, the protrusion may be caught in their grasp and, unless promptly reduced, the hemorrhoids may become strangulated. Thrombosis and edema of the anal orifice ensue, and finally gangrene may supervene. Occasionally an acute protrusion of the entire "pile-bearing" circumference occurs in cases that were formerly reduced spontaneously.

Pain.—Pain is not a characteristic symptom of simple internal hemorrhoids. Transient smarting or throbbing may occur at defecation but subsides soon after the protrusion has retracted into the rectum. A feeling of fullness in the

rectum, obstruction of the outlet, and incomplete evacuation at defecation are frequent symptoms, especially in women, with large internal hemorrhoids. The severe cutting pain, occurring at defecation, almost invariably denotes a complicating anal fissure.

Inflamed, thrombosed, strangulated hemorrhoids are excruciatingly painful and very tender. The pain is throbbing in character and the patient's efforts to assuage it are usually futile.

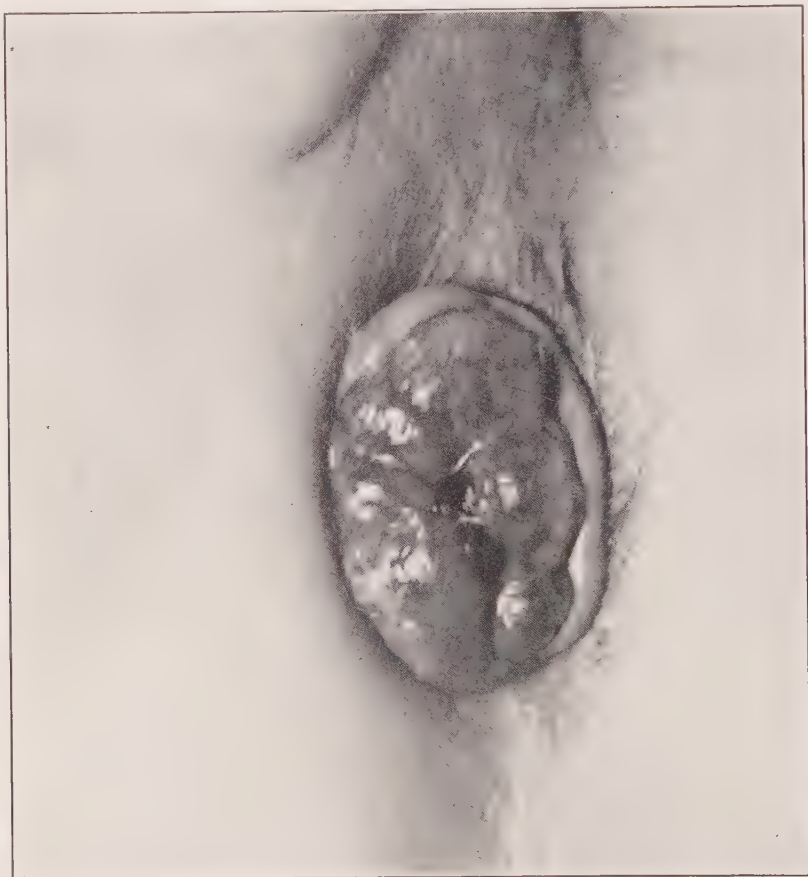


FIG. 120.—PROLAPSING INTERNAL HEMORRHOIDS.

Pruritus or itching of the perianal skin is a complaint in some cases of hemorrhoids. This occurs especially when protrusion is more or less constantly present. The leakage of mucus, laden with intestinal flora, irritates and infects the skin. Removal of the piles will usually effect a cure of pruritus of this type.

Constipation.—Although constipation is one of the chief causes of hemorrhoids, it is also frequently a consequence. Fear of bleeding and protrusion leads to postponement of the act, and aggravates the constipation and thus creates

a vicious circle. Indigestion and flatulence are direct consequences of the constipation.

Reflex Disturbances.—Functional disturbances of other organs are occasionally traceable to hemorrhoids. In men, these may manifest themselves as delayed or difficult urination, or a pain in the testicle; in women, as dysmenorrhea. Conversely, disease of other organs, as a tumor of the cervix, may cause reflex pain in the rectum. Pain may be misreferred to the skin areas supplied by the upper four sacral nerve segments. Thus the symptoms of lumbago or sciatica may be mimicked, or a dull ache over the sacrum be associated with internal hemorrhoids.

Rectal crises may occur rarely as an early symptom of tabes dorsalis. Pain after evacuation is marked but examination shows no rectal pathology to account for it. Discovery of the characteristic reaction of the pupils and the patellar reflexes points to the correct diagnosis.

Diagnosis.—Ordinarily the diagnosis of internal hemorrhoids is a simple matter. The methods employed in sequence are inspection, digital palpation and instrumental examination. The patient, in the Sims' position, is instructed to "bear down" while the examiner separates the buttocks and teases out the mucosa until the piles protrude. Usually the piles are exposed wholly or in part, at any rate sufficiently to show their situation and character. This method is usually successful. An associated anal fissure may, by irritation of the sphincter, inhibit extrusion. Rarely, when the sphincters are tight and the hemorrhoids small, they will not protrude.

It is a common error to rely upon digital examination for the diagnosis of hemorrhoids. If thrombosis or marked connective-tissue changes have occurred, the little tumors can be felt. Otherwise, digital palpation yields no reliable information as to the hemorrhoids themselves. However, digital examination should never be omitted, for hemorrhoids are frequently secondary to pathological conditions in the bowel above, notably carcinoma, many victims of which are still operated upon for "bleeding piles," although a simple examination would have revealed the true condition and given the patient the most favorable chance.

If, for any reason, the hemorrhoids cannot be protruded, diagnosis is made by direct inspection through an endoscope. Any tubular anoscope exposes clearly the entire circumference of bowel in which hemorrhoids develop. To save the annoyance of inserting several instruments, the author uses his 10-inch proctoscope for this purpose. This method has the double advantage of showing the condition of the distal sigmoid and rectum and, as the tube is withdrawn, the hemorrhoids prolapse into its lumen. Too much emphasis cannot be laid on the importance of doing a digital examination and proctoscopy in every case of hemorrhoids. Marked atony of the sphincters and a tendency of the anus to remain patulous after the local examination, are among the earliest signs of tabes dorsalis.

A puzzling question in diagnosis occasionally arises, when the patient passes tarry clots both with and independent of stools. Examination reveals active

internal hemorrhoids, but it seems incredible that through them so much blood should be lost. In these circumstances, a complete examination of the gastro-intestinal tract should be made to eliminate other possible sources of bleeding. This would, of course, include an x-ray gastro-intestinal series.

Case.—H. P., aged thirty-two, always in good health but constipated, during the three months before consulting me had passed fresh blood and tarry clots four or five times daily. Colicky pains in the lower abdomen preceded the evacuation of the clots. He had lost 27 pounds in weight and weakness was progressive. Hemoglobin 60 per cent. His history and general appearance were strongly suggestive of malignant disease. No masses or points of tenderness were found in the abdomen. The area of liver dulness was normal to percussion. Large and apparently bleeding internal hemorrhoids were present. A Wassermann blood-test was negative as was a gastro-intestinal series of x-rays. Hemorrhoidectomy promptly checked the bleeding and the patient rapidly regained his weight and strength. Over a year has elapsed without recurrence of bleeding. Thorough examination in such a case will often detect other and more important pathology.

On the other hand, especially in well-equipped institutions, much time and effort is expended in elaborate laboratory and other examinations, to determine the cause of anemia, weakness and progressive debility, while ignoring a careful examination for bleeding internal hemorrhoids, which is the basis of the condition in not a few cases. In every case of anemia it is essential to eliminate bleeding hemorrhoids as a possible cause.

General and Palliative Treatment.—The treatment of internal hemorrhoids varies with the stage of their development, local complications and general condition of the patient. In general it may be said that no case of well-developed internal hemorrhoids can be cured by palliative treatment. The symptoms may be relieved but cure is not effected. Early cases in constipated subjects, having slight bleeding as the main symptom, should be treated by palliation. The bowels should be regulated by limiting proteins and adding green vegetables and fruit. Mild laxatives and non-irritating cathartics are used sparingly. Agar-agar and mineral oil are the most useful type. Injection of 1 or 2 ounces of olive oil into the rectum before retiring is excellent to lubricate the anal canal and soften the feces. The injection of a cupful of cold tap water just before the stool stimulates peristalsis and is a local tonic. Pure ichthyol on a glass rod, applied through the anal canal, frequently will promptly check superficial oozing of blood. The smart pain following its use subsides in a few minutes. The applications may be repeated at intervals of three days. Suppositories are popular but their virtue is more in their lubricating properties than in the drugs they contain. Ointments come in more direct contact with the diseased tissues and are superior to suppositories. Of course they are more difficult to apply properly. Ointment may be conveniently dispensed in a collapsible tube with a special perforated tip 3 or 4 centimeters long. Slight pressure on the tube smears the tip. After introducing it through the anal canal, further pressure deposits sufficient ointment.

A more efficient but less agreeable method is to take a good portion of the ointment on the stalled index finger, and pass it well up through the anal canal. By rotating the finger, the ointment is brought in close contact with the diseased

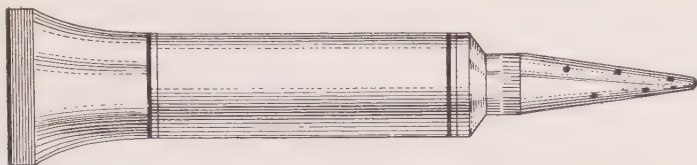


FIG. 121.—COLLAPSIBLE TUBE WITH CONICAL TIP FOR APPLYING OINTMENT TO ANAL CANAL AND RECTUM.

tissues and the moderate dilatation of the sphincters is an added advantage. Applications should be made night and morning. A good astringent ointment is:

℞	Ung. acid. tann.	℥ iv
	Ung. stramon.	
	Ung. bellad.	āā ℥ i

or, astringent and analgesic:

℞	Gall.	℥ iss.
	Opium pulv.	℥ ss.
	Petrolat.	ad ℥ i
M. et ft. ung.		

A suppository possessing soothing properties is made by incorporating anesthesin, 5 grains, in cocoa butter. Insert one after stool and before retiring.

Hemorrhoids Complicating Pregnancy and Parturition.—Pressure of the gravid uterus upon the large venous trunks causes distention and varicose dilatation of their tributary branches. Hence, hemorrhoids are a common complication of pregnancy. During labor, the fetal head strips the veins backward. This, with the incidental straining, frequently cause varicose internal and thrombotic external hemorrhoids, the latter often accompanied by perianal edema.

During pregnancy the prophylactic measures described under the palliative treatment of hemorrhoids should be applied. If hemorrhage and prolapse are persistent and debilitating, the hemorrhoids may generally be removed safely, under local anesthesia. As a rule, no interruption of pregnancy occurs. After parturition aided by local applications the hemorrhoids usually subside. External skin tags may remain and painful thrombi should be evacuated (see technic of operation for thrombotic external hemorrhoids). In the case of a young mother, if well-developed hemorrhoids persist, it is prudent to perform a radical hemorrhoidectomy after convalescence from her confinement, to avoid the probability of a recurrence of the complication during a subsequent pregnancy.

Prolapsed and Strangulated Internal Hemorrhoids.—Prolapsed hemorrhoids, caught in the grasp of the sphincter, swell quickly, so that the patient may not be able to replace them. When seen early, reduction can usually be

effected by placing the patient on his left side, bathing the parts with cold water and applying vaselin. Then, with the finger pushing up the apex of the mass, the other hand returns the marginal swelling, first on one side, then on the other. An adrenalin or other suppository is inserted and a gauze compress is applied firmly to the anus.



FIG. 122.—ACUTE HEMORRHOIDS WITH CORONA OF EXTERNAL EDEMA.

If, because of sphincter spasm, the protrusion cannot be returned within the rectum, the muscle should be relaxed under local or general anesthesia.

The mistake is frequently made of exerting taxis on strangulated, edematous externo-internal hemorrhoids. The external portion of the mass belongs outside and when replaced the entire swelling protrudes again almost immediately. Relief may be obtained by placing the patient in bed on his side with the hips elevated, cleansing the parts and applying compresses of boric acid, painting with adrenalin solution (1:1,000); boroglycerid, 25 per cent in glycerin; or lead and opium wash:

R	Liq. plumb. subacet.	℥ iv
	Tr. opii	℥ iiss.
	Aq. dest. q.s.ad	℥ iv

Sig. Apply locally on compress.

These measures may reduce the swelling to such a degree that the internal portion of the hemorrhoidal mass can be replaced readily within the rectum. When the sphincter is tight and the protrusion not replaced, thrombosis of the vessels and gangrene frequently ensue. Sloughing then occurs and spontaneous relief may be obtained, but at the expense of several weeks of needless pain, suffering and disability. Prolonged ulceration, abscess, or a fistula may be sequelæ. Under these circumstances, when the situation is fully explained to the patient and there is no other contra-indication to operation, he will usually accept immediate operation, which is the proper procedure for strangulated, sloughing piles. Relief is immediate, the hemorrhoids are cured, and no complications, other than those encountered in a simple hemorrhoidectomy, ensue. To limit the possibility of infection, the clamp and cautery is the operation of choice.

Injection Treatment.—This is a very valuable method of treatment of *uncomplicated* internal hemorrhoids. In many cases it works a radical cure. It is an old method. In 1871, Mitchell of Clinton, Illinois, first used carbolic acid as the injecting agent. Irregular practitioners, mostly itinerant, exploited the method, treating all varieties of hemorrhoids, often under unfavorable circumstances and with too strong solutions. Ulceration, sloughing and other complications occasionally ensued, but not as frequently as one might expect in view of the circumstances. As a consequence, the profession generally ignored the treatment without seriously investigating it. However, during the past twenty-five years, many surgeons, in various parts of the world, have investigated this method of treatment, defined the classes of cases in which it is suitable and placed it on a scientific basis.

Selection of Cases.—Only about 50 per cent of cases of internal hemorrhoids are suitable for the injection method of treatment. External piles should never be injected, although I have seen cases so treated by inexperienced physicians, with disastrous results. Internal piles complicated by fissure, fistula, polypus, or large external skin tags should not be injected, but removed at the same time as the complicating pathology. Inflamed, strangulated or markedly ulcerated cases should be operated upon and not injected. Spasmodic, contracted sphincters usually indicate infection and injection is not advised. Hemorrhoids which have undergone marked fibrotic change are not suitable for injection, nor are those which on the least exertion protrude constantly through an atonic anal canal.

Chemical Agents.—Carbolic acid, in various combinations, has been the essential popular agent. The following is the formula of the well-known Shuford's solution.

℞ Phenol.	℥ ii
Acid. salicyl.	℥ ss.
Sod. bor.	℥ i
Glycerin. (sterile) q.s.ad.	℥ i

This is a 25 per cent carbolic solution. I generally use a modified Shuford's solution, reducing the carbolic one-half, making a 12½ per cent solution. Equally good is:

℞ Phenol. liq.	M. xlvi
Glycerin.	
Aq. dest.	aa ℥ iv

This makes a 10 per cent solution. The tendency has been from stronger to weaker solutions, but those under 10 per cent are not efficient.

The other drug used for injection is quinin and urea hydrochlorid in a 5 per cent aqueous solution. E. H. Tirrell, of Richmond, Virginia, first used this drug in 1913. In 1924, Tirrell reported that he had used this remedy in three thousand cases and that "the results have been uniformly good." He had no deaths and only comparatively few minor complications. In this country, quinin and urea is growing in popularity.

Dukes studied microscopically the pathologic changes provoked by carbolic acid injections in ten patients. In each of these patients one hemorrhoid was injected in the usual way. The injected hemorrhoid and a control, not injected, were removed by operation; in one patient one day after injection, and in the remaining patients, from two to twenty-one days subsequent thereto. He concludes that "carbolic acid, being a powerful irritant to the tissues, initiates an aseptic inflammation, characterized by dilatation of the vessels, emigration of leukocytes, and transudation of lymph. By these means the alien liquid is diluted and removed, therefore the inflammation quickly subsides. All the changes observed microscopically represent the effort of the tissues to repair an injury. The curative effects of injections do not depend upon any specific action of the chemical substances. The early inflammatory changes which occur in the first three days do not play any important part in the cure of hemorrhoids; it is the secondary changes, in particular the intravascular clotting, and subsequent fibrosis, to which any beneficial effect must be ascribed."

Technic.—The rectum should be empty. The patient is placed in the left lateral position, the hips at the edge of the table and the right leg fully flexed at the hip and knee. Good illumination is essential and light reflected from a head mirror is very satisfactory. A Brinkerhoff anal speculum of medium size, smeared with a lubricating jelly—not vaselin—is introduced and, as the slide is withdrawn, a good longitudinal view is obtained which permits accurate injection. After the pile to be treated prolapses into the slot, the slide is adjusted to just cover the dentate line. For accurate control of the amount of fluid injected, the author uses a 1 c.c. Luer all-glass syringe with a goose-neck extension and a short, sharp needle of 25 gauge (Fig. 123). The mucosa is wiped dry and the point selected for puncture is touched with tincture of iodine. After this has

dried, the needle is inserted just above the base of the hemorrhoid and advanced to its center. Injection is made slowly, and after its completion, the needle is held *in situ* for a minute. After its withdrawal, a small pledget of cotton, saturated with grain alcohol is applied to neutralize the iodine and control any slight oozing of blood. The pressure is maintained until all bleeding has ceased. Vaseline is then smeared over the surface of the pile and the speculum removed, care being taken to restore the piles well within the rectum.

For small hemorrhoids, 3 to 5 minims of the carbolic solution are injected, and for the larger size, 5 to 7 minims. From 5 to 15 minims of the quinine and urea solution are used for each pile. Just enough fluid is injected to produce moderate distention. Blanching of the surface of the hemorrhoid indicates that too much fluid has been used or that it has been deposited too superficially in the mucosa. In either case, a slough would probably result. No sloughing occurs

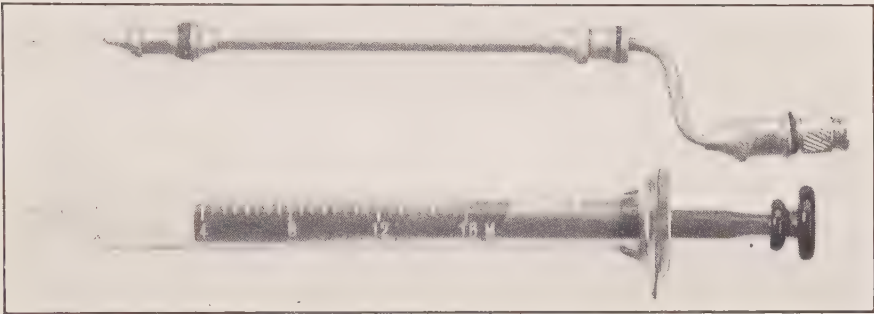


FIG. 123.—SYRINGE AND NEEDLE FOR INJECTING INTERNAL HEMORRHOIDS.

when the correct quantity of solution is properly placed. Infection, which should never occur with correct technic, may result in a marginal abscess and a fistula. No anesthetic is employed. Both the introduction of the needle and the injection should be painless. Pain at the time of treatment is evidence that the injection was made too near the anorectal line, and that some of the solution has infiltrated beneath the highly sensitive lining of the anal canal. A transient feeling of weight and fullness in the rectum follows the treatment quite regularly. Some surgeons inject two or more piles at one sitting. It is my practice to inject one at a time, and at intervals of five to seven days. Then, if any complication arises, its situation is known at once. Five to eight treatments suffice for an average case, but more may be required. One or two injections will usually control the bleeding like magic, and the patient be so satisfied with the symptomatic relief that he discontinues treatment. Treatment should be continued until all the hemorrhoids are completely shrunken.

The patient is allowed his usual diet. Daily bowel action is encouraged and the patient is instructed to replace any protrusion immediately it occurs. He should refrain from severe physical exertion for twenty-four hours after each treatment, but may keep business engagements.

Local examination should be made forty-eight hours after each treatment. Then the injected pile is felt as a firm swelling, tapering above into a cordlike induration. If at the end of two weeks the injected pile has not shrunk completely, it is injected again.

The technic is comparatively simple but must be executed with scrupulous detail. There is nothing secret or mysterious in the method but experience develops confidence and skill in its application. Before attempting it, the beginner will save himself needless anxiety by observing the procedure in the hands of a competent operator.

In suitably selected cases and with flawless technic, the injection method, more than any other, complies with the criteria of a satisfactory ambulatory treatment, *viz.*:

Little or no pain during or after the treatment.

No detention from business or social duties.

Symptomatic relief and more or less permanent cure, the parts being left in a healthy condition and functioning normally.

Personally the author has employed the injection method in several hundred cases with very gratifying results. Recurrences in two to five years are estimated to occur in about 15 per cent of cases. However, as the treatment is not onerous, the patients with recurrence are so well satisfied that they frequently return for another course of injections. It is important and a great convenience to keep an accurate record of the date, site, kind and quantity of solution used at each treatment.

Operative Treatment.—Surgical removal of hemorrhoids is by the open or the closed methods. The ligature and the clamp and cautery are the standard open methods. Excision and immediate suture by the Earle or the Whitehead operation typify the closed method.

In America, the clamp and cautery operation holds the same relative degree of popularity among surgeons as does Allingham's ligature method in England, and justly so. The author employs it more than any other operative method, and with most satisfactory results.

Preparation of Patient.—The bowel is emptied by the administration of 1 ounce of castor oil twenty-four hours before operation and enemas given till the water returns clear, six hours before the time fixed for its performance. The parts are not shaved but thoroughly cleansed with soap and water. One-half hour before operation a hypodermic of morphin $\frac{1}{4}$ grain and atropin $\frac{1}{150}$ grain is given. This calms the patient, arrests intestinal peristalsis, diminishes the quantity of anesthetic when general narcosis is used, and its prolonged effect lessens the pain after the operation.

Anesthesia.—Local infiltration anesthesia, with $\frac{1}{2}$ per cent novocain solution is adequate. "Sacral block" consists in injecting 1 ounce of 1 per cent novocain solution into the sacral canal and injecting the lower four pairs of sacral nerves, the technic of which is given in the chapter on Anesthesia.

Anesthesia produced by this method is ideal for all operations about the anus and lower rectum. Anesthesia is perfect immediately the injections are completed. Some training is required to perform the injections skillfully and there is a short period of delay while the technic is being carried out. In the considerable number of cases in which we have used it, no immediate or remote complications have arisen. Ether is the preferable anesthetic, when, for any reason, general narcosis is selected.

LOCAL ANESTHESIA.—The patient is placed in the left lateral position. The anus and surrounding skin are painted with tincture of iodine—no watery solutions are used—and the patient draped. The sacral plexus innervates the terminal rectum and the only sure way of anesthetizing all of the branches is by “sacral block.” Hence, for local infiltration, the anesthetizing solution is deposited entirely around the lower 2 inches of the anorectal wall in order to affect all of the nerve terminals. This requires about 2 ounces of a freshly prepared, sterile novocain solution of 0.5 per cent strength.

A record or glass syringe of 10 c.c. capacity and a needle 2 inches in length are used. A skin wheal is raised in the midline, 1 inch back of the anus. Through this the needle is advanced, and the tissues of the posterior half of the anal circumference are infiltrated to a depth of 2 inches. The infiltration is made very near the rectal wall, and by a slow but steady pressure on the piston. The sphincter muscles are then infiltrated. The needle is advanced on one side, partly withdrawn, and then the opposite side is infiltrated. Care should be exercised not to distort the hemorrhoids by infiltrating the field of operation. The syringe is detached from the needle for refilling. In like manner the anterior quadrants are infiltrated through a single puncture in the raphé. Thus only two punctures of the skin are made for the entire infiltration (Fig. 124). The operation should begin as soon as the infiltration is completed. The sphincters

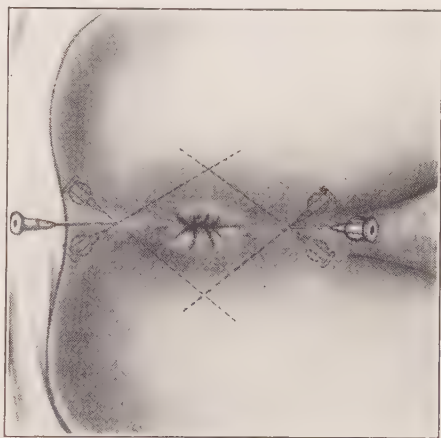


FIG. 124.—INFILTRATION ANESTHESIA OF ANAL CANAL.

The needle punctures the skin at a single point in the midline, posterior then anterior to the anus.

are relaxed just sufficiently to allow the hemorrhoids to be caught in forceps and drawn down so that the entire anal canal is everted. The anus is not divulsed except when spasmodic or actually contracted. After divulsion, sphincter tone is soon regained, or after healing, the anus is frequently too relaxed. The surgeon can then do a ligature or clamp and cautery operation, as he prefers. The ligature method will be found easier of execution under infiltration anesthesia, but with experience, it is equally successful for the clamp and cautery.

Ligature Operations.—The lateral position is used under local infiltration, and the lithotomy when general anesthesia is employed. Unless the sphincters are rigid and hypertrophied, or a complicating anal fissure is present, dilatation of

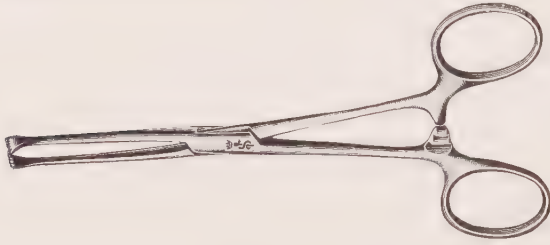


FIG. 125.—ALLIS INTESTINAL FORCEPS.

the sphincters, preliminary to hemorrhoidectomy, is not the general routine at the present day. If these conditions exist, the more reliable way to overcome them is to divide the sphincter just to one side of the posterior commissure. A clip is applied to the outer end of each hemorrhoid, and

fanwise traction on them exposes all of the piles for their entire length. The holding clip I have found most useful is the Allis forceps. They are light and hold firmly, but do not crush the tissues or cause bleeding. While an assistant holds the remaining forceps, the operator elevates the lowermost pile and divides with scissors the mucocutaneous margin. The hemorrhoid is dissected up and the mucous membrane divided part way on each side, until only a pedicle remains at the inner end of the hemorrhoid which contains the central artery and vein. A stout 10-inch ligature of celloidin linen is placed around the pedicle, and while the assistant makes traction downward, the ligature is tied very tightly, in a surgeon's knot, as high up as possible. The knot is toward the bowel lumen. The pile is ablated below the ligature, making certain that sufficient stump remains to hold the ligature. The ligature may be cut short, but I usually knot it about 3 inches from the anus and leave it protruding. Thus we know when all of the ligatures have come away, which averages from the eighth to the twelfth day. Each hemorrhoid, in turn, is treated in the same way, always removing those most dependent first in order to have the operative field unobscured by blood. When two hemorrhoids have coalesced, as they frequently do, the tumor is preferably treated as a single pile, but it is transfixed by a double ligature, which is then



FIG. 126.—LIGATION OF HEMORRHOID AFTER ALLINGHAM'S METHOD.

divided and tied separately on each side. Seldom should more than three hemorrhoids be ligated. Two important precautions are to be observed in performing the operation:

One device is to place the ligatures at slightly different levels, to avoid a tendency to narrowing of the canal and stricture formation; the other is to leave strips of mucosa between adjacent hemorrhoids, connecting the anal skin with the rectal mucosa. Omission of this essential point causes prolonged ulceration, delayed healing, and forms the basis of stricture formation, sometimes seen when the ligature and the clamp and cautery operations are done carelessly.

After ligating the internal hemorrhoids, any external hemorrhoids present are cut off and redundant anal skin treated. Redundant anal skin folds are prone to become edematous soon after the operation, thrombi frequently form in them, and later they are irritated by the discharge while the operative wounds are healing. As a result, they increase the discomfort of the patient's convalescence and, unless removed, they degenerate into external cutaneous hemorrhoids. Wedge-shaped sections of redundant skin, just below and in line with the operated piles, are excised. The margins of the wound coapt of themselves when the dressing is applied. The tissues beneath the operative wounds may be infiltrated to a moderate degree with 0.03 per cent quinin and urea hydrochlorid solution, as suggested by Hirschman. The needle is introduced through the raw surfaces. The prolonged anesthetic effect of this drug minimizes the after pains but may retard wound healing. The

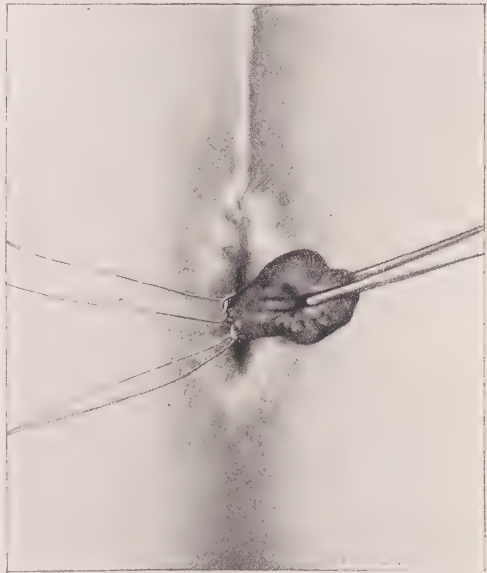


FIG. 127.—TRANSFIXION AND LIGATURE OF HEMORRHOID.

distal 5 inches of a No. 16 F. soft-rubber catheter, thickly smeared with sterile vaselin, is inserted into the rectum, a large safety pin transfixing its protruding end. Some surgeons prefer a wick of vaselin and others place no dressing into the rectum. Compresses of sterile gauze are packed snugly around both sides of the catheter and the buttocks are strapped tightly with strips of adhesive applied transversely (Fig. 128). The correct application of this dressing is a very important step in the operation. Properly applied, it supports and rests the parts; by compression, controls oozing of blood and the tendency of the perianal skin to edema, and guarantees against the tube

slipping out. The tube gives notice of bleeding, provides an avenue for the escape of gas and for injection of oil into the rectum.

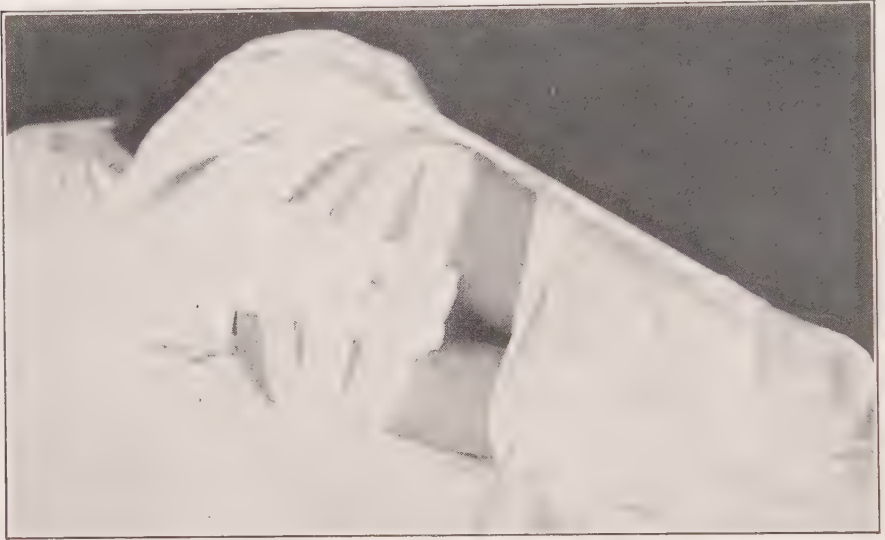


FIG. 128.—INTERNAL HEMORRHOIDS.

Buttocks strapped transversely to retain dressing and furnish support after operation.

Clamp and Cautery Operation.—In 1846, Cusack of Dublin devised this operation. H. Lee introduced it into London and H. Smith brought it prom-

inently before the medical profession of England. The preliminary steps of this operation are essentially the same as in the ligature method, except in the technic of dealing with the hemorrhoids proper. The lithotomy position is preferable, the legs being held in stirrups and the hips

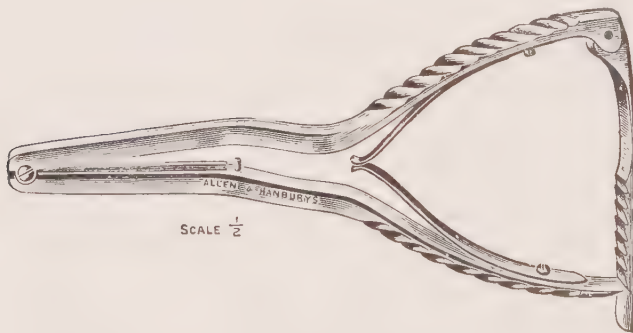


FIG. 129.—SIR C. GORDON WATSON'S PILE CLAMP.

well over the end of the table. Each hemorrhoid is grasped at its lower pole by an Allis forceps. It is important to secure each pile before beginning the operation; otherwise in searching for them, the eschar formed by the cautery may be opened and bleeding ensue. All of the forceps, except the one attached to the most dependent pile, are supported by an assistant. A second forceps now grasps the pile being treated, near its inner pole, bringing the entire tumor under perfect control of the surgeon. If no

redundant anal skin is present, the tissues at the mucocutaneous line are divided with scissors and the pile is elevated. Only the hemorrhoid is to be removed and, if present, any redundant anal skin immediately external to it. A V-shaped section of skin is dissected up to the outer pole of the pile. The base of the hemorrhoid is then snipped a distance of 1 centimeter only. The

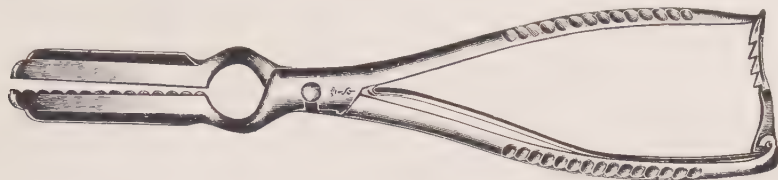


FIG. 130.—COOKE'S PILE CLAMP.

hemorrhoid clamp is next applied tightly to the base of the pile and always in the long axis of the gut. The heel of the clamp is toward the lumen of the gut, to place greatest pressure on the vessels of supply, and the thumbscrew is set. When applying the clamp, the blades must close in the groove made by the incision and no skin is embraced between its jaws. Severe pain will follow cau-

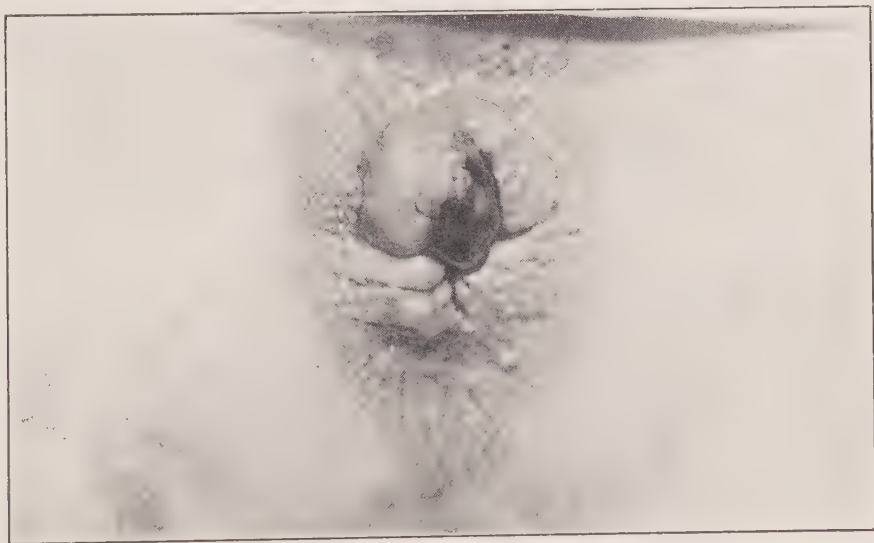


FIG. 131.—MIXED HEMORRHOID PREPARED FOR OPERATION.
Dark area, internal; light corona above it, external hemorrhoid.

terization of the skin. A split compress wet in saline is placed beneath the clamp to protect the underlying tissues. The pile is cut off about $\frac{1}{4}$ inch superficial to the clamp and the stump is charred slowly by an electric or Paquelin cautery, heated to a dull red. The clamp is released slowly to detect any bleeding points. There is seldom anything more than a slight oozing at the anal margin where the redundant skin was divided. Should there be appreciable bleeding



FIG. 132.—CLAMP AND CAUTERY HEMORRHOIDECTOMY.

Internal hemorrhoids everted by traction on Allis forceps applied at their lower extremities.



FIG. 133.—CLAMP AND CAUTERY HEMORRHOIDECTOMY.

Hemorrhoid steadied by forceps while pile clamp is being applied.

the vessel is clamped and touched with the cautery or tied with fine catgut. Each pile, in turn, is treated in the same manner. Any external hemorrhoids present are removed. A small rubber tube, well lubricated with sterile vaselin, is inserted into the rectum and the dressings are applied as in the ligature operation.

By the clamp and cautery method, at a single step, bleeding is checked, the stump sterilized and its avenues of infection sealed. In addition to the speed with which these desirable objects are accomplished, it has the important advantages over the ligature operation of leaving no ligatures or large stump



FIG. 134.—CLAMP AND CAUTERY HEMORRHOIDECTOMY.

Wet gauze compresses beneath clamp to protect the skin. Pile being ablated by electric cautery.

to slough away, and the wound heals, if anything, more quickly. Errors of technic are:

(a) Failure to divide the redundant skin before applying the clamp; if left, it will become edematous and cause marked suffering during convalescence, besides persisting as a skin tab.

(b) Failure to dissect up redundant anal skin and apply the clamp in the groove so formed, or including skin in the bite of the clamp. Either condition results in avoidable postoperative pain.

(c) Failure to fix the clamp with the thumbscrew before cutting away the pile; the latter is apt to slip during cauterization and bleed.

(d) Cutting the pedicle too short; it should be cut close to but not flush with the clamp, in the case of the small piles not cut at all, and simply charred, not burned away.

(e) Applying the clamp in the transverse instead of the long axis of the gut, thus favoring stricture.

(f) Removing too much healthy mucous membrane with the pile; longitudinal strips of healthy mucosa must always be left between adjacent stumps to prevent overcontraction.

Excision and Immediate Suture.—The closure of operative wounds about the rectum accords with the strife for perfection in surgical technic. However, it violates the cardinal principle of free drainage in rectal surgery. Experience teaches that, although primary union is obtained in a few selected cases, failure

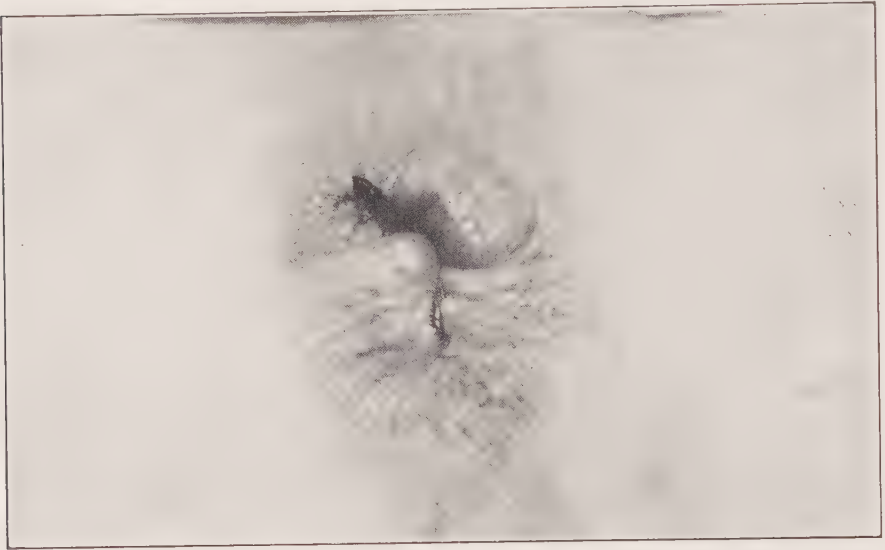


FIG. 135.—CLAMP AND CAUTERY HEMORRHOIDECTOMY.
Appearance of eschar after removal of clamp.

occurs in the vast majority, because of the omnipresent intestinal flora and the difficulty of keeping the parts clean.

WHITEHEAD'S OPERATION.—In 1882, Walter Whitehead, of Manchester, England, introduced total excision of the hemorrhoidal area, namely, the lower $1\frac{1}{2}$ inches of the rectal mucosa. Since, by this method, the entire cuff of hemorrhoidal mucosa is removed, it appeals strongly to the surgeon on theoretical grounds, not only as radical, but the operation of choice. Experience, however, has demonstrated its drawbacks, so that now it is practically obsolete. While it can be performed in any case of internal hemorrhoids, its use should be restricted to those in which the entire circumference of mucosa prolapses with the hemorrhoids. Even in these, other methods will usually prove to be more satisfactory.

The essential steps in the modified Whitehead operation are: Sacral block or general anesthesia. Lithotomy position. Then (a) a submucous blunt dissec-

tion from above downward instead of from below upward, before dividing the mucosa, accomplished by introducing curved scissors through a transverse slit at the mucocutaneous juncture in the posterior commissure worked up to the healthy mucosa, insinuated about to the anterior commissure and thence worked down to the cutaneous margin on each side; (b) liberation of the cuff by a circular incision just within the mucocutaneous border; (c) stretching the sphincter, thus preserving the landmarks until the dissection is completed, which simplifies the procedure; (d) posterior division of the cuff up to healthy mucosa; (e) circular amputation of the cuff in stages at the upper limits of disease, and sewing the sound mucosa to the mucocutaneous border previously severed for its entire circumference except for a distance of 1 centimeter at the posterior commissure, which is left open for drainage. Neglect of this precaution favors submucous hematoma which is almost certain to become infected. Chromicized catgut on a round-bodied curved needle is used in a continuous suture, one suture being applied to each side; (f) insertion of a tube of $\frac{1}{2}$ inch diameter. Strict aseptic and antiseptic precautions must be observed throughout the procedure. The bowels are confined for six or seven days and the wound kept dry and clean.

Well-founded objections to the operation are: Infection of the wound, resulting in more or less retraction of the mucosa; local loss of special sense, due to removal of the terminal nerve-endings, so that the patient may have no warning of an impending bowel action; stricture formation, or, as has happened in inexperienced hands, excision of a section of the sphincter, prolapse and incontinence resulting; eversion of the mucosa by placing the incision too low; and finally, the not infrequent recurrence of the hemorrhoids. In an analysis of the follow-up histories of 158 cases operated upon by the Whitehead method, Stone found that thirty-seven showed some impairment of rectal control and in fourteen cases there was a recurrence of symptoms.

EARLE'S METHOD.—To overcome many of the objections to the Whitehead operation, Earle, of Baltimore, has proposed modifications of the technic

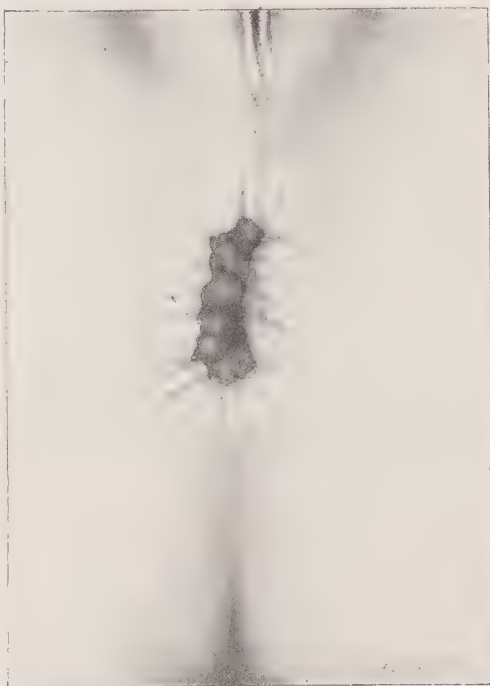


FIG. 136.—EXSTROPHY OF MUCOUS MEMBRANE FOLLOWING FAULTY WHITEHEAD OPERATION.

whereby, without any dissection, the hemorrhoids are removed and the mucosa sutured. He devised a special forceps for this purpose.

After the usual preparation, the operation is performed under local or general anesthesia. The lithotomy position is most convenient. The sphincter is dilated gently. One of the hemorrhoids is elevated with forceps and the Earle clamp (Fig. 137) tightly clasped at its base in the longitudinal axis of the rectum. The pile above the clamp is cut off. A catgut suture on a curved needle is

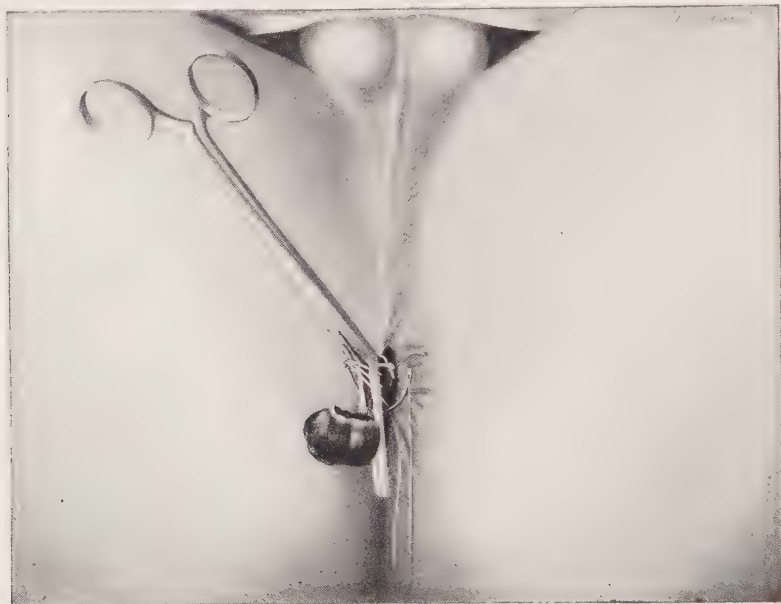


FIG. 137.—LIMITED EXCISION OF HEMORRHOIDS WITH EARLE'S FORCEPS.

passed just beneath the toe of the clamp and tied. The suture is then continued as a running suture, passed beneath, then over the top of the clamp, until all of the pile within the grasp of the clamp has been sutured. The loops of the suture are left rather loose so that the clamp can be released and withdrawn readily. This done, the loops are drawn tight from above downward, thus closing the wound, and the suture is tied with a running knot. Each hemorrhoid is treated in turn, care being taken to leave a strip of skin and mucosa between adjacent lines of suture.

Electricity in the Treatment of Hemorrhoids.—The chief methods of applying electricity in the treatment of hemorrhoids are by:

1. Electrocoagulation or surgical diathermy
2. Electric desiccation
3. Galvanopuncture or ionization
4. Simple galvanism

These methods of treatment should be limited to uncomplicated cases of simple internal hemorrhoids. They require costly and cumbersome apparatus and special training in technic. They accomplish by a roundabout method what can be more directly and positively done by injection, the ligature or the clamp and cautery.

Simple galvanism does not cure hemorrhoids but is a useful palliative measure. The claimed effects of the positive pole are coagulation of the albuminoids of the blood and hardening of the tissues, constriction of the blood-vessels, reduction of inflammation and relief of pain. Neiswanger, in his *Electrotherapeutical Practice*, gives the following technic: "Place the patient on the table in the Sims' position, wet thoroughly a pad as large as the hand, or larger, attach it to the negative terminal of the battery and place upon the abdomen. The positive is connected with the rectal electrode which is then carefully introduced with the curved side down, pushing up with the electrode any fringe or prolapsed membrane. The current is now turned on by means of the rheostat until twenty milliamperes is reached, and allowed to flow for ten minutes. In most cases the treatment may be every second day." A special electrode is used, consisting of a copper bulb mounted upon a short insulated carrier with a receptacle for the cord. This is covered closely with a portion of a kid glove and lubricated with stiff jelly before insertion.

Galvanopuncture (Ionization).—A speculum, preferably of hard rubber, is inserted. Anesthesia of the pile, to be treated, is obtained by the local application of a powdered anesthetic or by local infiltration. The active electrode is a needle of zinc (ionization) or iridoplatinum (galvanopuncture), insulated except 2 millimeters of its tip, by fusing on it hard sealing wax or hard rubber. The negative pole is attached to a large moist pad placed under the patient's hips, and the needle is attached to the positive pole. The needle is inserted into the apex of the pile until stopped by the insulation. The current is turned on gradually up to 10 or 15 milliamperes, where it is maintained for five to ten minutes. The current is turned off gradually when the pile changes to light gray color, and the needle is withdrawn. Only one hemorrhoid is treated at each sitting. Neiswanger condemns the method on account of the subsequent pain, and dangers of hepatic and cardiac embolism from setting free in the circulation products of decomposition. The author concurs in his view.

Electrodesiccation or High-Frequency Method.—The heat is generated in the tissues by their resistance to the current which is of just sufficient intensity to desiccate (dehydrate) and so devitalize the tissues. A monopolar current is furnished by a standard high-frequency machine, generating an Oudin type of current. Anesthesia is by infiltration of the perianal tissues and external sphincter with novocain and adrenalin solution. The current strength varies with the size of the hemorrhoid. A pile clamp is applied loosely to each hemorrhoid, in turn, and the tissues superficial to the clamp are desiccated. When the pile is small, the needle is held a short distance from it; if of medium size, the needle makes contact with the mucosa; when the hemorrhoid is large,

the needle is inserted into it. On account of the slough, pain and enforced confinement to bed, electric desiccation possesses no advantages over the older, reliable methods.

Surgical Diathermy or Electrocoagulation.—When a high frequency current is passed through tissues, its electrical energy is converted into heat energy. The heat developed in the tissues varies directly as their resistance to the current, and is easily raised to the point of coagulation. The principle involved, therefore, differs from burning with the actual cautery by which the heat is applied from an external source and penetrates only slightly. A standard diathermy machine is used which generates a bipolar (d'Arsonval) type of current. This should be of low voltage, high amperage and very high frequency. The patient is prepared as for any other operation for hemorrhoids. In the lithotomy position, the parts are anesthetized by local infiltration of a novocain-adrenalin solution. An indifferent electrode of block tin about 8 inches square is so placed that the patient's hips rest upon it, and it is connected to one pole of the machine. To the other pole is connected a Bierman clamp which is, in effect, two parallel, active, insulated electrodes. This special clamp limits the coagulation to the tissues between its metallic edges. A foot switch to control the current is advantageous to the operator.

Each hemorrhoid is grasped, in turn, by forceps and the pile clamp so held as to slightly compress its base in the long axis of the bowel. The current is turned on until the base of the pile is coagulated to a thin long pedicle of light gray color. Then, with an electric knife, attached to one cord of the clamp, the pile superficial to the clamp is cut off.

The beginner should practice coagulation on thin strips of raw beef, to familiarize himself with the proper adjustment of the diathermy machine. Cross sections through the treated areas show the extent of the coagulation and enable the operator to estimate the amount of current to be used for hemorrhoidectomy. Advocates of surgical diathermy vaunt it, as an ambulatory method. However, rest in bed for a few days is prudent and adds to the patient's comfort, as there may be considerable pain. The slough separates in about a week or longer, and the indolent wounds, in healing, form scar tissue as after other methods of surgical removal of hemorrhoids. In simple uncomplicated cases of internal hemorrhoids, the final results are good.

The treatment of hemorrhoids by electricity is outlined for the sake of completeness. The author does not recommend its use except for palliation and in certain selected cases of uncomplicated internal hemorrhoids.

Complications.—Complications after a properly performed clamp and cautery or ligature operation are absent or trivial. However, immediate or remote complications may occur and the surgeon should be familiar with them in order to treat them correctly.

Retention of Urine.—This is most likely to occur where excessive packing is placed in the rectum, when the tissues have been needlessly traumatized and when operation results in swelling at the anal margin. By careful clean technic,

retention does not occur, or its tendency is overcome by the simple measures outlined under Postoperative Treatment. After removal of too tight packing and, if necessary, a single catheterization, normal bladder function is usually established.

Hemorrhage.—According to the statistics of Gabriel, the unfortunate complication of severe secondary hemorrhage, requiring active interference, occurred in five of 475 cases, or about 1 per cent, operated upon for hemorrhoids at St. Mark's Hospital. The average period after operation was seven days and the bleeding always followed a movement of the bowels. Usually it results from slipping or too early separation of the ligature, or the opening of a vessel when the slough comes away. All of these except the latter are avoidable by proper technic—non-absorbable ligatures tied tightly in a square knot, and, for large pedicles, transfixion and double ligature. With the clamp and cautery method severe hemorrhage may occur immediately after the operation unless the operator makes certain that all actively bleeding points are controlled during the operation, individual vessels being tied if necessary. The dressings stanch the oozing at the anal margin. Secondary hemorrhage after the clamp and cautery method is a rare complication, but may occur when the slough separates on the seventh or eighth postoperative day. No severe hemorrhage has occurred in any case in which I have performed the ligature operation, and in only two of several hundred cases in which the clamp and cautery was used. The first was in a young man in my early practice and occurred immediately after operation. Of course it was due to an error in technic in not securing a vessel bleeding at the time of operation. Fortunately the bleeding stopped spontaneously. The other was a man who had a large hemorrhage while walking in the street on the eighth day after operation. He was admitted to the hospital and the bleeding was controlled by packing. The characteristic feature of this sort of hemorrhage is that it is largely concealed. Large blood-clots fill the rectum and sigmoid, while there is very little external evidence of bleeding. The patient has an urgent desire for bowel action and exhibits the signs of acute secondary hemorrhage—anxiety, pallor, thirst, thready pulse, etc. No stimulants should be given. It has been observed that as the blood-pressure falls there is a tendency of the blood to clot in the vessels and the bleeding to cease spontaneously. Should the signs and symptoms indicate that bleeding has been checked, active interference may be delayed or altogether refrained from. In any event, unless the case is desperate, active interference should be deferred till facilities are available to carry it out properly. The two methods of controlling the hemorrhage are by packing with gauze and by ligating the vessel or suturing the tissues *en masse*. Under general anesthesia, the clots are washed out with hot water (110° F.) aided by the finger. Then the healthy rectal mucosa just above the operated area is caught at several points with clamps and dragged down, thus everting the bleeding field. A spurting vessel may thus be exposed and ligated. Frequently, however, it has retracted beneath the mucosa, or there is a general oozing of blood. Under these circumstances, a suture may be passed

and tied about the bleeding area, or a T-forceps may grasp a bleeding area and a ligature be tied about it. When the mucosa is fragile and diseased, ligatures and sutures should not be used as they will cut through the tissues and augment bleeding. As a rule, attempts to locate the bleeding point are futile and the manipulations may open other vessels.

In general, the best plan is to pack the bowel. Firm packing of the anal canal is effective in the majority of cases. A rectal retractor is inserted and superimposed strips of gauze, 6 inches long, are inserted into the rectum, their ends protruding, until the anal canal is tightly packed. The gauze may be moistened with styptics as alum, adrenalin, glycerite of tannic acid, or one of the newer agents, as thromboplastin or coagulen, in liquid or powder form.

When the location of the hemorrhage is in doubt or is in the lower rectum where anal canal packing does not exert pressure, the most reliable method is to insert a proctoscope and with a long alligator forceps insert through it a fourfold strip of gauze 4 inches broad and 1 yard long. A stout double cord is tied to one end of the gauze and the gauze is wound spirally about it. The knotted end of this gauze is passed first into the rectum, then the rest, the other end together with the cord projecting through the anus, when the proctoscope is withdrawn. The cord is drawn tight and securely tied over a large compress applied to the anus. Thus firm constant pressure is exerted on the tissues between the rectal packing and the anal compress. The packing may be removed safely in two or three days.

Perianal Edema and Skin Tags.—Edema of the anal skin occurs in a small fraction of cases after operation. Elevation of the hips and application of a hot-water bottle will usually cause subsidence of the swelling in a few days. If palpation detects thrombi in the edematous area, the blood-clots should be turned out at once, using local anesthesia, and at the bedside. Otherwise skin tags will persist and the patient may complain that not all of the piles were removed.

Small inflamed tags, sometimes seen after operation, usually shrink of their own accord. If quite large, they should be anesthetized and snipped off with scissors, flush with the skin, about ten days after operation.

Fissure.—The development of a fissure during or after hemorrhoidectomy is usually due to the passage of large masses of feces. Routine use of mineral oil after operation should prevent it. If it occurs as a complication, it should be treated according to the methods given in the chapter on Fissure of the Anus.

Infection and Sepsis.—These should never occur in the ligature, or clamp and cautery operation with correct technic and proper postoperative care. When the wounds are closed by suture, the occurrence of local infection might be expected, although no statistics in this respect are available.

Stricture.—The frequent occurrence of stricture after the Whitehead operation is alone sufficient to condemn it. Mild degrees of stenosis of the anal canal and actual stricture may occur after the other types of operation. Narrowing is due to denuding too great a surface of the anal canal (faulty technic), or

failure to routinely dilate the canal, beginning a week or ten days after the operation.

Incontinence.—As already noted, partial or complete incontinence may result from the Whitehead operation. A number of patients operated upon for hemorrhoids elsewhere have consulted me for poor control of liquid feces and gas. Evidently the sphincters had been overdivulsed, preliminary to a simple hemorrhoidectomy.

Recently I did a plastic repair of the sphincter in the case of a young lady in whom a section of the muscle had been excised during hemorrhoidectomy, performed elsewhere, which had resulted in a complete prolapse of the rectum, 6 centimeters in length.

Recurrence.—Recurrence of hemorrhoids varies with the method employed and the thoroughness of the technic. There is no doubt that recurrences are more frequent after the injection treatment, than when the hemorrhoids are removed by operation. Nevertheless, in view of the slight inconvenience of the injections, many patients are satisfied to have them repeated. Terrell, using quinin and urea and injecting only uncomplicated cases of internal hemorrhoids, states: "When properly selected and a faultless technic is employed, cures, approximately 100 per cent, will be obtained." Morley, who employs the injection method almost exclusively and uses carbolic acid, received follow-up replies from three hundred consecutive cases which he had injected three years or upwards previously: 83.4 per cent reported themselves entirely free from rectal symptoms, and 16.6 per cent had a return of some sort of rectal discomfort. The majority of the latter had remained perfectly comfortable upward of two years. It is generally conceded that recurrence is more frequent after the Whitehead operation and after local excision and suture, than when the ligature or clamp and cautery operation is employed. Examination after the Whitehead method frequently shows, that what the patient considers a recurrence of the hemorrhoids is, in fact, a partial or complete prolapse of the rectum. The causes of recurrence, after the ligature or clamp and cautery operation, are that some of the hemorrhoids were overlooked at operation, or that the factors causing congestion or obstruction of the superior hemorrhoidal veins, continue to be operative, *e.g.*, cirrhosis of the liver, pelvic tumors, retroversion of the uterus, hypertrophied prostate and urethral stricture.

A careful check-up on a large series of consecutive cases, several years after operation, would be very enlightening. Sir Gordon Watson states: "Of the 1,000 cases dealt with, 29 had a previous operation for hemorrhoids. Of these 29, only 11 were submitted to a second operation; in other words, the recurrence percentage requiring reoperation is only about one per cent." The probability of recurrence after a properly performed clamp and cautery or ligature operation is so slight, that it need scarcely be taken into account.

Postoperative Treatment.—The patient rests in bed upon the back with pillows beneath the thighs and buttocks or may lie on either side, as is most comfortable. A hypodermic injection of morphin, $\frac{1}{4}$ grain, is administered as

soon as pain is complained of. Repetition of the morphin is seldom necessary. Codein phosphate in $\frac{1}{2}$ grain doses suffices for the later pain, but aspirin, 10 grains, or pyramidon, 5 grains, are preferable and frequently more efficacious. Pressure of a distended bladder aggravates the patient's discomfort.

A dram of the following mixture is given in water every three hours until spontaneous micturition occurs:

R	Methenam.	℥ ii
	Sod. benz.	℥ ii
	Tr. hyosc.	℥ ss.
	Aq. dest. q.s. ad.....	℥ ii
Sig.		Teaspoonful in water every 3 hours.

This cystitis mixture should be continued thrice daily when catheterization is necessary. If allowed to stand by the bed, male patients can usually void; and females, in the kneeling position, can empty the bladder in a pus basin and so avoid soiling the dressings. The patient may have no desire to void or, having the desire, be unable to do so. In any case the bladder should be emptied in twelve to eighteen hours. When other measures have failed, a single catheterization at this time will usually be followed by normal bladder function.

I prefer a restricted diet till the bowels have moved. Water is allowed freely, clear tea and coffee, chicken and lamb broth with rice or noodles, toast, crackers and gelatin jellies. This satisfies the majority of patients and has the decided advantage of producing a dietary control of bowel action and scarcely any gas pains.

The dressing is changed in twenty-four hours, and daily thereafter, the skin cleansed with peroxid of hydrogen and dried, and a T-binder substituted for the adhesive plaster to retain the dressings. On the third postoperative day 10 ounces of warm cottonseed oil are injected through the tube, the tube clamped, and two hours later 1 or 2 quarts of 2 per cent boric acid or normal saline solution are injected through the tube. The tube and all dressings are removed and the patient evacuates on a commode. The parts are then washed clean and a small quantity of borated vaselin applied on sterile gauze. Regular diet is ordered and the patient is allowed out of bed. Heavy liquid petrolatum is given in $\frac{1}{2}$ -ounce doses at 7 A.M. and 10 P.M., to regulate the bowels. If a tube was not inserted at the time of operation, the first bowel action is obtained by administering 1 ounce of castor oil with orange juice, the second night after operation, or 2 drams of compound licorice powder stirred in a cupful of hot water. A hot sitz-bath after defecation cleanses and soothes the parts.

The patient leaves the hospital on the fifth to the seventh day after operation and is usually able to resume his accustomed occupation about one week later. On the tenth postoperative day the stalled index finger lubricated with 10 per cent ichthyl ointment is passed into the rectum to smooth out the granulating surfaces and guard against any tendency to stricture formation. This is repeated once a week until healing is complete, which averages four to five weeks from the date of operation. Neglect of this important step of post-

operative care is responsible for narrowing and even annular fibrous stricture of the anal canal sometimes occurring, even after a properly performed ligature or clamp and cautery operation. During convalescence it is usually advisable for the patient to take a tonic.

R
 Tr. nuc. vom..... ʒ ii
 Sod. glycerophos. ʒ iii
 Aq. dest. q.s. ad..... ʒ iii
 M. Sig. ʒ i, t.i.d., p.c.

If the patient is anemic, liquid Blaud with nux vomica and arsenic should be ordered, a teaspoonful in water, before or after meals, or *The National Formulary*, elixir of iron, quinin and strychnin, one dram in water after meals.

The foregoing technic and after treatment are routine on the author's service at the New York Polyclinic Hospital. In the hundreds of cases in which they have been followed the results have been most satisfactory.

REFERENCES

- DUKES, A. Cuthbert. *Brit. M. J.*, Lond., No. 3316, 1924, p. 102.
 EARLE, S. T. *Matthews' M. Quart.*, Louisville, Jan., 1896.
 GABRIEL, W. B. *Lancet*, Lond., July 17, 1920, 2: 121.
 MORLEY, Arthur S. *Hemorrhoids*, London, Oxford University Press, 1923.
 STONE, Harvey. *Ann. Surg.*, Phila., 1913, 2: 647.
 TIRRELL, E. H. *Tr. Am. Proctol. Soc.*, 1924, p. 73.
 WHITEHEAD, Walter. *Brit. M. J.*, Lond., 1882, 1: 149.

CHAPTER VII

PRURITUS ANI

Pruritus ani (vulvæ and scroti) is a condition of the skin about the anus, the chief symptom of which is itching, and is characterized by chronicity and a tendency to recurrence. Whether it is a symptom of an underlying condition or a disease entity has been the subject of endless discussion and no conclusion satisfying to all has been reached. Evidence of the increased professional interest in the subject is the great number of articles appearing in medical literature during the past generation.

Occurrence.—Persons with thin delicate skin are especially susceptible, and blonds rather than brunettes. All classes of society are affected, but surprisingly those in the better walk of life are more frequently victims. The most fastidious are often the greatest sufferers. Men are affected much oftener than women, the ratio being about four to one. The usual ages are from the twenty-fifth to the fiftieth year, with a minority of children and a few old people (pruritus senilis). Persons in apparently otherwise robust health frequently are victims. Any condition that conduces to more or less constant moisture of the perianal skin favors the development of pruritus. Thus in the corpulent who perspire freely, the parts are moist and chafing is common.

Etiology.—Pruritus ani has been found in association with almost every disease of man, and to consider all of these causal makes confusion more confounded. In as much as pruritus, at its beginning at least, is a symptom and not a disease entity with a specific therapy, an attempt will be made to classify the sundry causes on the basis of their mechanics and with a view to the treatment.

Any one who has examined carefully a large number of pruritic patients must have observed the local congestion present. *Congestion* in the portal circulation, due to obstruction, favors local congestion, as does pressure which interferes with the return flow in the hemorrhoidal veins. As etiologic factors, then, there are diseases of the liver and gall-bladder, rectal carcinoma and stricture, displacement and tumors of the uterus; the straining associated with cystitis, hypertrophied prostate, seminal vesiculitis and urethral stricture. A sedentary life, alcoholic beverages in excess and overeating, especially of rich and highly seasoned foods, tax the digestion, surcharge the portal circulation and congest the liver. Carbohydrate fermentation and protein putrefaction set up a catarrhal inflammation of the intestinal mucosa. Acrid mucus, escaping with the flatus, irritates the perianal skin and causes itching. This is especially noticeable in chronic hypertrophic coloproctitis, while in the atrophic variety,

hard, constipated stools exert back pressure on the rectal veins. In constipation congestion is aggravated by straining efforts at stool. Ingestion of certain articles of diet, as tomatoes, strawberries and the many varieties of shellfish, may be followed by a general pruritus in individuals having an idiosyncrasy for them (protein hypersusceptibility). Urticaria with general itching is the usual manifestation, but anal pruritus may thus be initiated or paroxysms brought on in chronic cases. In a somewhat analogous way, certain drugs induce intolerable perineal or generalized itching; common examples are morphin, cocain, quinin, and belladonna.

Certain constitutional diseases produce irritation by toxic products of metabolism in the circulation, or abnormal constituents of the plasma, notably in diabetes mellitus, rheumatism and gout. Presumably abnormal constituents of the blood or normal constituents in excess produce local vasomotor changes or directly irritate the peripheral nerve-endings. Theoretically the itching should be general, but when confined to the perineum, a local impairment of tissue resistance may be assumed. Senile pruritus is probably in this class and an endocrine disorder may be an etiologic factor.

Coexistent pathology of the anus and rectum is the cause in the majority of cases. The ordinary lesions, having a pathologic discharge which causes irritation of the perianal skin, are fissure and ulcer of the anus, papillitis, cryptitis, fistula, or a suppurating sinus; prolapsing or ulcerated hemorrhoids, and catarrhal and ulcerative diseases of the rectum and colon. A tight sphincter and rectal constipation are important local factors. Skin tabs about the anus harbor feces and bacteria and neglect of cleansing ablutions after defecation instead of coarse or printed paper are direct causes. Uterine or vaginal disease with a leukorrhæal discharge may be a local irritant. Following anorectal operations a temporary pruritus, due to the discharge, frequently persists until the wound is healed. Pediculi in the perianal hairs may rarely excite a pruritus. In children the chief assigned causes are condylomata and worms.

Oxyuris vermicularis (pin- or seat-worms) are found in the cecum and rectum of children. The *Tricocephalus dispar* (thread-worm) inhabits the large intestine. Worms may cause reflex disturbances, or itching within the anal canal or at its orifice when concealed between folds of mucosa or perianal skin.

Streptococci Infection.—During the years 1911-1919, the late Dwight H. Murray carried out extensive investigations on the etiology and treatment of pruritus ani. Observations made on two hundred cases convinced him that infection of the perianal skin by a strain of streptococcus, namely, *Streptococcus faecalis*, was the etiological factor in all cases. In some cases he found a complicating infection by *Staphylococcus aureus* or *Bacillus coli*. He considered poikilogenic factors—sundry and many under different conditions—as heretofore enumerated, coincident and not causal. Another point was his study of the opsonic index of his patients. In 1919, Murray stated: "Enough of my cases were examined to prove that the coefficient of extinction of opsonins for *Streptococcus faecalis* is low, and that pruritus grows less as the phagocytosis

increases. Anything that will raise it to par, will stop the itching. We do not know yet what it is that lowers the resisting power against these germs; but, when it is raised by vaccine or any other method, if the same condition persists, the resistance may be lowered again. If it is thus lowered and the patient is unclean, he will surely be reinfected, and the itching will surely return. This fact is the crux of recovery."

So far as our present knowledge goes, the course of events is approximately as follows: As a result of the poikilogenic factors a slight tickling or itching,



FIG. 138.—PRURITUS ANI.

Typical appearance of advanced case. Note hypertrophied skin folds. Fissures and superficial ulcerations are present.

at first not unpleasant, occurs in the anus or perianal skin. Rubbing or scratching affords temporary relief but produces a traumatic productive dermatitis. Eventually, the scratching causes skin abrasions which favor infection and a chronic infective dermatitis is established. The fæcalis strain of streptococci is isolated most frequently in skin cultures but *Staphylococcus aureus* and *Bacillus coli* are not infrequently associated or may be the only growth recovered. On account of the chronic changes in the skin the pruritus may persist even after the original cause has been corrected. For the purposes of treatment, the condition at this stage may be considered a disease entity.

Pathology and Distribution.—At the onset there may be no demonstrable gross changes in the skin or only a congestion. In the effort to relieve the

itching the patient scratches (traumatizes) the skin, producing a chronic productive inflammation in its deeper layers. Later, abrasions and fissures become portals of entry for the omnipresent bacteria and an infective process is added to the traumatic dermatitis. By staining methods, bacteria have been demonstrated in the tissues in a few cases in which the epidermis was broken but absent when the skin was intact. Whatever the original cause, after the condition is established the constant local pathology is a chronic dermatitis with progressive changes.

In chronic cases, the skin appears thickened, especially the radiating folds, pale in color from loss of pigment, moist and abraded or fissured, largely the result of scratching. In inveterate cases, as a result of the subcutaneous fibrosis, the skin is parchment-like, smooth and leathery and at times kraurotic. The terminal nerve-endings may be compressed by the new formed fibrous tissue and aggravate the itching. The changes occur especially in the midline posterior and anterior to the anus, frequently involving the vulva and scrotum, and may extend one or more inches laterally. When a large area is involved, the condition resembles eczema.

Symptoms.—The chief symptom is a severe, tantalizing local itching. The itching may be intermittent, continuous or paroxysmal, the attacks lasting ten to fifteen minutes. The itching varies in intensity, is usually worse at night after retiring and may be brought on by changes in temperature, contact with the clothing, by defecation, or by exercise that induces sweating. Involuntary scratching temporarily relieves the intolerable itching, but traumatizes the skin and eventually aggravates the pathology and symptoms. Loss of rest and sleep and constant irritation have a deleterious effect upon the patient. Mental torture and physical suffering may unfit the patient for social or business duties and be expressed in neurasthenia or melancholia. While it is more difficult to control and eliminate the itching in neurotic individuals, as a rule, the unstable nervous system is not causal but is a consequence of the pruritus.

Diagnosis.—History and physical examination usually make the diagnosis a simple matter. In early cases the cutaneous lesions may be slight but in chronic cases the skin presents the appearance described under Pathology. A magnifying glass will aid in the discovery of worms or pediculi. Sources of local infection must be sought, notably the anal canal for ulcer, fissure, or suppurating or infected sinus.

Internal hemorrhoids may be present, but unless prolapsing and ulcerated, they are not an etiological factor. In fact, it is a common experience that ablation of symptomless internal hemorrhoids, by opening new paths of infection frequently intensifies the itching.

Inspection of the rectosigmoidal mucosa is important to determine if this is a source of pathologic discharge as in ulcerative colitis or ulcerated stricture. The majority of these patients do not complain of pruritus, the perianal skin apparently not being susceptible.

On the other hand, a typical pruritus is frequently present when no other

coexistent local pathology is demonstrable. It is for this reason that a thorough general examination must be made to discover pathology in the liver, the gastrointestinal tract, the urogenital tract, or elsewhere; foci of infection, as the teeth and tonsils, and systemic disease, which may cause the pruritus, especially when no local condition is found competent to produce it. Chemical and microscopical examination of the urine and feces should be routine measures.

The intensive study of diabetes in recent years indicates that the pruritus of this disease is general or, if local, usually affects the vulva, where it is probably due to direct irritation by sugar-laden urine. Pruritus ani in men suffering from diabetes is exceptional. Joslin states: "Pruritus pudendi frequently occurs in diabetes and will usually vanish within a few days, but occasionally not until two weeks after the disappearance of sugar from the urine. General pruritus, on the other hand, is exceptional, may be annoying and persist for weeks. If pruritus vulvæ does not clear up promptly as the urine becomes sugar free, an examination will probably disclose a prolapse, leukorrhea, or urinary incontinence."

Differential Diagnosis.—Pruritus ani must be differentiated from certain skin diseases having itching as a symptom that may affect this region, any one of which may be mistaken and treated for pruritus ani. The most common of these are eczema marginatum, urticaria, herpes, scabies and ringworm.

Prognosis.—The prognosis is guarded. While relief may be promised, guarantee against recurrence should not be given. Early cases are frequently cured but chronic cases may run a course of twenty or thirty years, with periods of remission and recurrence. Cases dependent upon an associated anal or rectal lesion may promptly and permanently clear up when this is eradicated, but in others the skin changes are so profound and the disease so entrenched that treatment of the pruritic zone must be continued many months before the skin is restored to normal and itching disappears.

Treatment.—Treatment is general, local, by x-rays, by vaccines and by operation. Proof of the difficulties of therapy is the large number of drugs tried with varying success, and in recent years vaccines, x-rays and surgery have had their innings. Each of these remedies and measures have relieved or cured some cases but none of them is a specific. In treating a case of pruritus ani, the first and most important thing is to determine, if possible, the underlying cause in that particular case by a complete history and thorough physical examination.

General Measures.—In the majority of cases the diet should be modified. Tea and coffee should be limited in quantity; water, especially alkaline waters, drunk freely; alcoholic beverages interdicted; meat, fish or eggs are allowed once daily, sweets reduced and spices are omitted. Fermented milk, preferably *B. acidophilus*, is a beneficial addition to the diet. Cotton or linen underwear should be worn and a small anal pad of absorbent cotton, the latter to be changed whenever it becomes moist. As an aid in keeping the parts dry powder may be dusted on the cotton. The one I have found most effective is:

℞ Phenol Gr. x
 Amyli. pulv. ʒ iv
 Pulv. zinc. oxid. q.s. ad. . ʒ i

The patient should sleep in a cool room and under light bedclothes. Patients are cautioned against scratching during the day, and if they do so unconsciously while asleep at night, they should wear white cotton gloves that can be washed.

When the harassing itching produces insomnia sedatives may be used temporarily. Under no circumstances should opium derivatives be ordered, for in such a chronic condition the patient will almost surely become an addict. Sodium bromid, 20 grains in water before retiring, or one of the coal-tar group of hypnotics, as veronal, may produce quiet and restful sleep. Constipation should be relieved by modified diet and mild laxatives, which produce mushy, non-irritating stools. Any residue remaining in the rectum after defecation is washed out with a ½ pint of 2 per cent boric acid solution. After bowel action and before retiring the parts should be cleansed with cotton wet in warm water, followed by witch hazel, and the parts blotted dry with cotton. Many mild, early cases, due to contamination by the feces, may be cured by these simple measures. If an anorectal or a perianal skin lesion is present that may act as a focus of infection or keep the skin moist with a pathologic discharge, it should be corrected by operation. Chief among these are skin tags which make cleansing difficult, ulcers, and fissures of the anus, hypertrophied anal papillæ, cryptitis, mucosal prolapse and ulcerated or prolapsing internal hemorrhoids. The operation technic is given under the respective headings. Following the operation a careful anal toilet must be maintained for several months.

Local Treatment.—Local applications vary with the conditions of the affected skin. In general, dry applications are more effective than ointments or aqueous solutions. If the parts are acutely inflamed, painful and itching, soothing applications should be used, as lead and opium wash, lime water, calomel and lime water (black wash), magnesium sulphate 4 drams, water 1 pint, or,

℞ Phenol. liq. ʒ i (4 c.c.)
 Calamin. præp. . ʒ ii (8 Gm.)
 Zinc. oxid. ʒ iv (16 Gm.)
 Glycerin. ʒ vi (24 c.c.)
 Liq. cal. hydrox. ʒ i (30 c.c.)
 Aq. ros. ʒ viii (240 c.c.)
 Sig. Apply as required to control itching.

An excellent cream is:

℞ Calamin. præp.
 Zinc. oxid. āā ʒ iss.
 Liq. cal. hydrox.
 Aq. dest. āā ʒ iss.
 Glycerin. ʒ ss.

A soothing ointment is:

℞	Phenol	Gr. x
	Zinc. oxid.	℥ i
	Ung. aq. ros.....	℥ ii

To fissures or cracks in the skin, silver nitrate should be applied which forms a protective coating of silver albuminate.

℞	Arg. nit.....	Gr. xv
	Sp. aeth. nitrit.....	℥ i
	Sig. Apply every other day till healed.	

Pure ichthyol is very efficient in subacute and chronic cases when applied twice weekly in the office on a glass rod to the affected skin and anal canal. The incidental smarting ceases in ten minutes and relief is frequently afforded for twenty-four hours or longer.

When the skin is thickened and leathery, more stimulating applications may be required. The temporary annoyance occasioned by their application is compensated for by the prolonged relief obtained. As a rule, the benefit derived from the application of strong chemicals which cause an exfoliation of thickened epidermis, seems scarcely justified in view of the pain and suffering they entail. Pure carbolic acid and saturated solution of silver nitrate have been used for this purpose. An application I have found most generally useful was suggested by the late George J. Cook, of Indianapolis:

℞	Hydrarg. chlor. corr.....	Gr. ii
	Ol. ricin.	℥ iv
	Alcohol 95 per cent q. s. ad	℥ ii
	Sig. Apply at night or night and morning.	

Too frequent application may cause irritation. No cotton or pad is to be worn after the application, the parts being left exposed to the air. A valuable stimulating ointment is:

℞	Phenol liq.	℥ xv
	Sulphur præc.	℥ iii
	Ung. hydrarg. nit.	
	Adeps lan. hyd.....	āā ℥ ss.
	Sig. After bathing with hot water and drying the skin, apply for one or two hours.	

When the skin presents an eczematous appearance, olive oil on cotton should be substituted for water for local cleansing. The following ointment is then useful:

R	Sulphur præc.	5 i
	Acid. salicyl.	Gr. xv
	Acid. benz.	5 ss.
	Petrolat. q.s. ad	5 i

Great relief and comfort is frequently afforded by alcoholic preparations which are cleanly, astringent and antiseptic. One of the best is:

R	Alcohol (pure grain).....	5 iii
	Fl. ex. hamam.....	5 v
Sig. Apply freely after stools and before retiring.		

Other methods to combat infection, restore the skin to normal and relieve itching are:

1. X-rays
2. Ionic medication
3. Vaccines
4. Subcutaneous injections
5. Operation

Roentgen Rays.—X-rays have been used extensively in the treatment of pruritus ani and vulvæ. In the majority of cases temporary relief is obtained, and cure is effected in possibly 15 per cent or less of cases. Some operators use unfiltered rays and others the screened rays. Treatment may be intensive or fractional, preferably the latter. Remer recommends an initial dose of one-half skin unit; second week, one-third skin unit, and weekly thereafter one-fourth skin unit until a total of two skin units have been given, unless a satisfactory result has been obtained before. If there is no improvement after six applications the treatment is discontinued. Pruritus due to local causes, as infection, responds more favorably to the rays than does the so-called essential variety. Felix Gaul reported on nineteen cases of the latter class, eleven of which were reëxamined, five being cured, four improved and two unimproved.

Irritating drugs should not be used on the pruritic area for two weeks before, during or after exposure to the rays. Safe drugs include phenol 2 to 4 per cent, zinc oxid, witch hazel, alcohol, lanolin and plain vaselin. A danger inherent to the x-rays, when the dosage is not carefully controlled, is radio-dermatitis which may degenerate into epithelioma of the squamous or prickle-cell type. The numerous patients applying for relief after treatment by the x-rays are eloquent proof of the failure of the method in those cases at least.

Ionic Medication.—On the assumption that pruritus is due to an infection of the skin, usually by the *Streptococcus faecalis*, Rolfe applied to this region the experimental work of Leduc, who demonstrated that the ions of metallic salts, liberated by electrolytic action, can be carried to a depth of 1 to 10 millimeters into the tissues. Rolfe found the most suitable agents to be 1 per cent aqueous solutions of zinc sulphate, zinc permanganate, mercury oxycyanid, all

electropositive; and iodine (Lugol's solution) and potassium iodide, both electro-negative. Rolfe believes that the antiseptic ions have not only a bactericidal effect, but a lytic one, as well, and that not until the exudate is softened by lysis and resolution is complete, is permanent relief from pruritus to be expected.

A special apparatus is required, consisting of a motor transformer which reduces the current to 50 volts or less and a current regulator to adjust the amperage from 0 to 10 milliamperes. The indifferent electrode, moistened with warm saline solution, is applied firmly to the abdomen. The active electrode of brass or copper is covered with cotton saturated with the warmed medicament and is pressed firmly against the affected area. The amperage is gradually increased until the patient feels a warm sensation. It is maintained for fifteen minutes, then gradually reduced to zero. Varying with the conditions, the applications are made daily or usually three times weekly. When the skin is irritated, moist and blanched, zinc permanganate solution is tried first. If this fails, oxycyanide of mercury is used. Iodine solution is used when the skin is dry, thickened and fissured. The treatment is continued until objective signs of improvement are evident and several weeks after itching has ceased. This means fifteen, twenty or more applications and it is difficult to have patients continue treatment once the symptoms are relieved. Rolfe's statistics indicate the value of this method of treatment in selected infective cases not dependent on associated anorectal pathology. While not uniformly successful, the majority of his patients were relieved and a proportion cured.

Ultraviolet Rays.—A quartz burner mercury lamp, activated by an alternating or direct current of electricity, is the source of the ultraviolet rays. The quartz burner consists of an arc tube, two transverse mercury containers to which the electric current is delivered, and mercury sealed electrodes. The actions claimed for the rays are germicidal, alternative effect on the tissues and tanning of the skin, depending upon the intensity, frequency and duration of application. It is claimed that pruritus responds readily to the rays, two to six radiations often proving curative. A second or third degree erythema is produced, allowed to subside, and if the pruritus is unrelieved, the treatment is repeated. Theoretically this should be a good form of treatment but in the limited experience of the writer with the rays in refractive cases of pruritus ani, the results have been disappointing.

Vaccine Therapy.—Obviously this form of treatment is suitable only for cases of pruritus ani due to infection, usually *Streptococcus faecalis*, according to Murray. An autogenous vaccine is made from a surface culture of the cleansed pruritic skin. Usually a growth of colon bacilli and sometimes *Staphylococcus albus* also occurs. Any benefit derived from the use of vaccines must be through the immunity they confer. The action, therefore, must be a specific or a non-specific protein reaction. Murray used a strong vaccine—2,000,000,000 dead organisms per c.c., beginning with small doses rapidly increased to massive doses. Owing to the difficulties in procuring autogenous vaccine complying with Murray's standards, this form of treatment has not been popular. Other workers

have not been able to duplicate the successes reported by Murray. The field of its applicability is limited to the infective type of pruritus ani, which comprises a minority of cases. In them an autogenous or stock mixed vaccine may, frequently with advantage, be combined with local treatment.

Subcutaneous Injections.—Various chemical substances have been injected beneath the skin of the pruritic area to relieve the itching. The majority of these contain an anesthetizing agent, as quinin and urea hydrochlorid, and their effect is transient. We have tried a number of these, but the only ones possessing merit in our hands are alcohol and benzocain.

Stone states that there is no satisfactory treatment for pruritus ani, but he considers injection of alcohol the best treatment with which he is familiar. The principle upon which this method is based is the well-known destructive effect of alcohol on nervous structures; in the case of pruritus ani, the network of fine terminal sensory filaments that supply a varying area of skin.

TECHNIC.—With the patient in the lithotomy position and under light general anesthesia, the field is prepared as for any other operation. As a rule the inflamed and indurated appearance of the skin itself indicates the region to be injected. Pure, undenatured 95 per cent grain alcohol is injected with a small hypodermic syringe using a fine short needle. The needle is plunged vertically through the skin and two to four drops of alcohol deposited in the subcutaneous tissue at each puncture. The punctures are placed about $\frac{1}{4}$ inch apart over the entire area involved, which may include the scrotum and labia majora. Injections are not made within the anal canal but punctures are made up to $\frac{1}{4}$ inch from the anal margin. After completing the injections, the field is sponged off with alcohol. No dressing is applied. There is a little after-soreness, and if the injection has been properly performed, the itching is abolished at once. There is numbness of the perianal skin, but no disturbance of the sensory features of the act of defecation. Within a few days after the treatment there is a remarkable return of the skin to normal appearance. Skin sloughs may follow the technical error of injecting too large a volume of alcohol through a single puncture. During the past ten years over two hundred patients have been treated by this method at the Rectal Clinic of Johns Hopkins Hospital. A few cases were apparently cured, some have been relieved for several years, but in the great majority itching recurred in from six to twelve months. Then repetition of the injections affords relief for another period. In over forty cases injected by the writer, the results have corroborated the experience of Stone. This method is valuable and should be tried when other local measures fail, or when it is imperative to check the itching promptly.

Benacol.—As a result of experiments to discover a more satisfactory preparation for subcutaneous injection, benacol was evolved in our clinic. It is supplied in 2 c.c. ampules by the Seydel Chemical Co., Jersey City, New Jersey.

Benacol solution consists of 5 parts each of para-aminobenzoylethanol benzoate and phenmethylol in ninety parts of rectified sweet almond oil. The chemical formula is $C_{16}H_{17}O_4N$ and C_7H_8O . It is non-toxic, highly anesthetic, mod-

erately antiseptic, and appears to have a mild depressant action on the peripheral nerve-endings.

The technic of injection is as follows: The perianal skin is prepared with tincture of iodine. An all-glass syringe of 2 c.c. capacity, fitted with a 22 gauge needle, $1\frac{1}{2}$ inches in length, is filled with benacol, which is injected *slowly beneath* the skin and the mucocutaneous junction of the perianal region, and distributed as evenly as possible fanwise from the peripheral margin of the pruritic area inward to the anal verge. It is essential to inject the solution just beneath and not into the skin. Intradermal injection is apt to be followed by a slough of the skin, as occurred in three of our early cases. The average amount injected at one sitting in a single quadrant of the perianal tissues is 2 c.c., beginning with the quadrant in which the itching is most intense. Treatments are repeated at intervals of two or three days until the entire perianal region has been injected. The same area may be safely reinjected in five days and repeated at this interval, if necessary, until the itching is entirely relieved. No preliminary anesthesia of any kind is required with benacol and nothing should be added to it.

As a rule, the injections are painless, if given slowly, which makes it advantageous for office treatment and is in striking contrast to alcohol, hydrochloric acid and other chemicals used for pruritus ani. No systemic reactions or manifestations have been encountered. In a few cases a moderate degree of local pain, lasting from one to four hours, was experienced. Relief from itching over the injected area usually follows the treatment immediately.

During the past two years we have treated approximately seventy-five cases of mild, moderate or severe pruritus ani and two of pruritus vulvæ in our clinic at the New York Polyclinic Medical School and Hospital and in private practice. Very marked relief or satisfactory improvement has resulted in 90 per cent of these cases. Our records indicate that permanent relief may be expected in a considerable proportion of cases. In several instances distinct reparative changes in the skin were noted as the itching subsided. All in all, no other drug or method of treatment which we have tried has yielded results at all comparable with those obtained with benacol.

Surgical Treatment.—After other methods have failed, for inveterate cases of pruritus ani with thickened skin and fibrous tissue, which entangles the sensory nerve-endings, Sir Charles Ball proposed undercutting of the involved skin to sever the nerve-twigs before they reach the skin. "A curved incision is made on each side of the affected area, enclosing the entire ellipse with the exception of a narrow neck in front and behind. These incisions are carried down to the sphincter muscle, and the flaps raised by careful dissection with scissors from the surface of the muscle, round its anal margin, and up the anal canal to above the mucocutaneous junction, the dissection extending round the entire circumference, all connections with the subjacent tissues being divided. The pedicles in front and behind are now undercut to a point well beyond the area of irritation, and the outer concave edges of the incision are also undercut to a distance of at least one-fourth inch free of the involved skin all around.

Care must be taken to stop all bleeding and the flaps should not be replaced until it is completely arrested, as the formation of a hematoma in the wound might compromise the vitality of the flaps. The flaps are finally replaced and retained by sutures, a few intervals being left between them for drainage. The immediate result of this operation is to render the entire ellipse included between the incision, the pedicles and the outer edges as far as they have been undercut, superficially anesthetic, and the itching is at once relieved."

Because of the prolonged confinement to hospital entailed by Ball's operation and occasional slough or retraction of the skin flaps, the technic has been

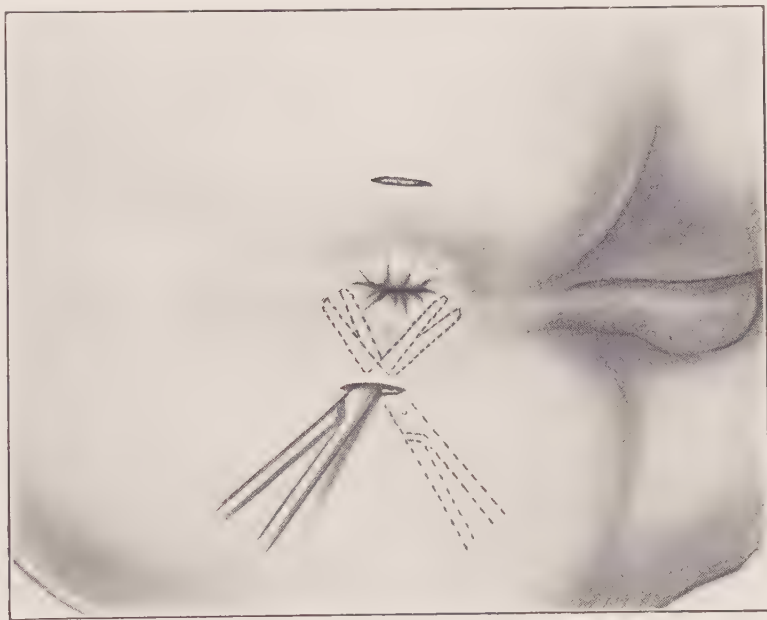


FIG. 139.—PRURITUS ANI.
Undercutting operation.

simplified, preserving the principle of undercutting and eliminating the drawbacks of large skin incisions, which favor retraction of the flap and impair its vitality. Long radial and short peripheral skin incisions, variously placed, have been proposed by Hamilton, T. C. Martin, Lynch, Krouse, and others.

AUTHOR'S METHOD.—Infiltration of the prepared skin and subcutaneous tissue with 0.5 per cent novocain solution or sacral (caudal) anesthesia is satisfactory. A skin incision of $\frac{1}{2}$ inch is made on each side or in each perianal quadrant, at a distance of $1\frac{1}{2}$ inches from the aperture (Fig. 139). A pair of sharp scissors with thin blades curved on the flat is essential. The scissors are introduced through each incision in turn and by short clips the skin is freed in its entire circumference. Then the scissors are advanced superficially to the sphincter and, on its anal aspect, the lining of the anal canal is freed well above

the mucocutaneous junction. During the dissection one must use great care not to "buttonhole" the flaps. Blood-clots are expressed by rolling gauze over the surface, radially from the anus, and firm compression is applied until bleeding ceases. If the skin external to the incisions is involved it may be elevated as far as is desired through the same incisions. Rubber dam drains are inserted and left in place for forty-eight hours. A large dressing of fluffed gauze completes the procedure. The patient may leave the hospital two days after the operation and the wounds are usually healed two or three days later. If due regard to asepsis has been observed, no infection occurs and the flaps, receiving a central and peripheral blood supply, do not slough. Of course, they do not retract as the short skin incisions do not permit retraction. Operative anesthesia lasts from two to four weeks when normal sensation gradually returns. Ball reports complete and permanent relief in fourteen cases he operated upon, and Mummery "completely cured" fifty-two of fifty-nine cases in which he did the Ball operation. The experience of other operators in effecting cures by the undercutting method have been less fortunate, due, in some cases at least, to an incomplete operation. Permanent relief in 50 per cent of cases is a high average. Recurrence in the remainder within six months to two years may be expected. To guard against recurrence, local applications should be made to the skin to restore it, as far as possible, to normal.

REFERENCES

- BALL, Sir Charles. *The Rectum*, Oxford University Press, 1908, p. 324.
GAUL, Felix. *Strahlentherapie*, Berl. u. Wien., 1924, pp. 310-326.
JOSLIN, E. P. *The Treatment of Diabetes Mellitus*, Philadelphia, Lea and Febiger, 1923, p. 591.
LEDUC, Stephane. *Electric Ions and Their Use in Medicine*, London, Rebman, 1908.
MURRAY, Dwight H. "Vaccine Treatment of Pruritus Ani," *Tr. Am. Proctol. Soc.*, 1919, p. 112.
REMER, J. *The George Blumer Edition of Billings-Forchheimer's Therapeutics of Internal Diseases*, New York, D. Appleton & Co., Vol. I, p. 612.
ROLFE, Wm. A. "Treatment of Pruritus Ani by Ionic Medications," *Tr. Am. Proctol. Soc.*, 1921, p. 32.
STONE, H. B. "Pruritus Ani; Treatment by Alcohol Injections," *Surg., Gynec. & Obst.*, Chicago, 1926, 42: 565.
YEOMANS, F. C., GORSCH, R. V., and MATHESHEIMER, J. L. *Tr. Am. Proctol. Soc.*, 1927.

CHAPTER VIII

COCCYGODYNIA, NEURALGIA AND HYSTERIA OF THE RECTUM

COCCYGODYNIA

In 1858, Sir J. Y. Simpson of Edinburgh coined the term coccygodynia (κόκκυξ coccyx, + ὀδυνή pain) to designate as a definite entity certain painful conditions in and about the coccyx. Coccygodynia is usually classified as a neurological affection, and has received scant attention in medical literature. In practice, it is a border-line condition and may be either medical or surgical. The earlier writers, notably Simpson, thought that the pain was due to traction on the coccyx by the attached muscles and ligaments. More recently several theories have been advanced as to the etiology of the pain:

1. The *neuralgic* theory, advocated by Marro, Pozzi, and others, that an initial trauma caused violent nerve irritation which persists without any demonstrable anatomical nerve lesion.

2. *Neuritis*, as occurred in twelve cases of labor due to pressure of the fetal head on the terminals of the sacral plexus (Gräfe).

3. *Theory of injury* of the coccyx, resulting in fracture, dislocation, ankylosis or caries.

4. *Symptomatic*, *i.e.*, a referred pain of central origin due to many functional or organic diseases of the nervous system. Starr mentions its frequent occurrence in neurasthenic and anemic persons, chiefly in women, and states that it may be associated with irritable spine and traumatic neurosis. Strümpell mentions its presence in two cases of tabes dorsalis. Pain about the coccyx and anus is fairly common in tabes but usually occurs at intervals.

Theories 1, 2 and 3 are based on trauma and comprise the major number of cases, while the few remaining are symptomatic, which accords with clinical experience. In the traumatic cases the impact may be from within the pelvis or external. Difficult labor is the chief example of internal violence. Instances resulting from external force are by far the most common and usually there is the history of a fall, kick, horseback or automobile riding which may cause injury of the soft parts only, or fracture, dislocation, ankylosis, or caries of the coccyx, and result in neuralgia or neuritis of the coccygeal plexus. Rarely there is a gross lesion of the coccyx, but as a rule the injury affects the periosteum alone and the soft structures adjacent or attached to the bone—fascia, ligaments, muscles and nerves. Coccygodynia is encountered in women much more frequently than in men.

Anatomy.—The nerves comprising the coccygeal plexus are the fourth and fifth sacral, the coccygeus and probably the inferior hemorrhoidal branch of the internal pudic. On the anterior surface of the coccyx there are also two ganglia of the sympathetic, connected to each other by fine nerve filaments, and by other filaments to the last sacral ganglion of the chain which constitutes the pelvic sympathetic (Hamant and Pigache). Irritation of any portion of a nerve plexus so intimately related to the sympathetic and the central nervous systems may cause protean disturbances of sensation. Jointly the nerves supply sensation to the integument over the coccyx, around the anus and the intervening area, and innervate the levator ani, sphincter ani and coccygeus muscles, all of which are attached to the os coccyx.

The coccyx is a small bone, but gives insertion to the levator ani (in part) and coccygeus muscles on its posterior surface, the gluteus maximus (part of origin) on its anterior surface, while the sphincter ani is inserted on its tip. The sacrosciatic ligaments are also attached to it. Thus the coccyx is surrounded by dense structures, largely fibrous, which the delicate network of nerves penetrates. Injury of these structures initiates an inflammatory reaction, with proliferation and later contraction of the new fibrous tissue and compression of the nerves.

Fracture, dislocation or deviation of the coccyx may cause pressure pain. Pressure upon the nerves by the bone or contraction of the injured soft parts produces neuralgia. Maintained pressure may result in neuritis or neuritis may occur at the beginning if the trauma is severe.

Symptoms.—These usually develop promptly after an injury. The predominant symptom is a characteristic spasmodic or aching pain, usually localized to the region of the coccyx, but at times, radiating to the perineum or bladder. The pain is increased by sitting or rising, and occasionally by urination and defecation. Consequent avoidance of stool may result in constipation. While it may be a symptom of an hysterical condition, conversely long-continued coccygodynia is prone to develop a neurosis or neurasthenia in the patient.

Diagnosis.—This is made on the history and by a thorough examination, both general and local. The former embraces the spinal column to discover injury or disease as caries or sacro-iliac strain, and the nervous system to exclude tabes dorsalis, or other central nerve lesions. Local examination is made with the patient in the Sims' position. The index finger is passed into the rectum and the coccyx is grasped, between it and the thumb outside (Fig. 140). Thus the position, contour, mobility and tenderness of the coccyx, sacrococcygeal joint or anterior branches of the sacral nerves can be determined at once. Next, the soft parts just distal and then lateral to the tip of the coccyx are compressed. The patient will usually cry out with exquisite pain when the affected portion of the coccygeal plexus of nerves or diseased bone has been squeezed, and the pathognomonic symptom elicited.

Lesions of the anal canal and rectum, simulating coccygodynia, are to be excluded by the local examination. The most usual of these are anal fissure of ulcer, cryptitis, papillitis, thrombosed hemorrhoidal veins, blind internal fistula,

cicatrices of previous operations and foreign bodies in the rectum. Proctoscopy should always be done. In women, a pelvic examination is made, and in men, the prostate, seminal vesicles and the urethra are examined to exclude pathology which might cause reflex pains.

Prognosis.—In general the prognosis is good. Many cases, especially those following parturition, recover spontaneously, after a few weeks or many months.

Treatment.—Recent cases should be treated conservatively. Rest is indicated while the symptoms are acute. Retention enemas of warm olive oil insure easy



FIG. 140.—COCCYODYNIA.

Bidigital examination to determine point of maximum tenderness.

bowel action and are soothing to the injured parts. Aspirin is helpful. External heat with a therapeutic lamp twice daily for one hour is recommended. Faradization has been used in some cases and with reported success.

Injection Treatment.—Direct attack on the affected nerves, with the object of causing their degeneration, has been applied by the injection of 60 to 80 per cent grain alcohol in one of three ways:

(a) Through the third and fourth sacral foramina, thus affecting the corresponding pairs of sacral nerves (Lippens).

(b) Deposit of 2 c.c. of 60 per cent alcohol at front and back of sacrococcygeal joint (De Vesian).

(c) Injection of 10 to 20 minims of 80 per cent alcohol at the point of maximum tenderness as determined by bidigital examination at the time of treatment (Yeomans).

The latter treatment, proposed by the author, is an application of the principle of injecting sensory nerves with 70 to 80 per cent alcohol, thereby causing their degeneration, as suggested by Schlösser of Munich in 1907, and practiced with marked success in trifacial neuralgia.



FIG. 141.—COCCYODYNIA.
Technic of injection.

TECHNIC.—The injections are made easily at the office under strict aseptic precautions. With the patient in the Sims' position, the skin in the region of the coccyx is sterilized with tincture of iodine. A 2 c.c. aseptic syringe is filled with 80 per cent grain alcohol and fitted with a 2-inch needle of 25 gauge. With the index finger in the rectum, the point of maximum tenderness is determined by counterpressure with the thumb outside. Usually this is just distal to the coccyx or slightly lateral to it. Maintaining the finger in the rectum as a guide and to guard against its puncture, the needle is inserted through the skin in the midline directly to the tender point. When this is reached, the patient may exclaim with exquisite but tolerable pain, and 10 to 20 minims of alcohol are injected slowly (Fig. 141). The needle is withdrawn quickly and the iodine on the skin is neutralized with alcohol. The pain from the injected alcohol lasts a few minutes

only, but a dull ache may persist for twenty-four hours. A single injection has cured a few cases, but generally, owing to the broad distribution of the coccygeal plexus of nerves, two to ten treatments with an average of three or four have been necessary. The interval between treatments is from five to seven days, and the alcohol is always deposited at the point found most tender at the time of injection.

CLINICAL DATA.—Of thirty-six cases treated by this method, twenty-eight were females with an average age of thirty-four years, and eight males, average age twenty-nine years.

External trauma was causal in twenty-three cases, a fall in eighteen of these; internal injury (difficult labor) in six, while two followed local operations and in five the cause was not determined. Thus trauma was causal in 80 per cent of this series. Duration of the pain before treatment was from three weeks to fifteen years, averaging over twenty-two months.

The coccyx felt normal in twenty cases, was distinctly thickened in four, of irregular contour in two (fracture), dislocated in three, directed backward in two, forward in one, was ankylosed in three, and had been excised without relief in one.

RESULTS.—Clinically cured, twenty-three; partial relief, eight; failed, five. Elapsed time since treatment, six months to twelve years. Relief for several years justifies the expectation of a permanent cure.

Surgical Treatment.—Excision of the coccyx is a comparatively simple operation, but should be reserved for those cases in which the bone is diseased, detached, dislocated, fractured or ankylosed in a faulty position, or after the injection treatment has failed. The fact that occasionally the pain persists after removal of a clinically normal coccyx, and is relieved in others, indicates that in those that were relieved the affected nerves were removed together with the bone.

EXCISION OF COCCYX.—With the patient in the Sims' position and under general anesthesia (or sacral block local anesthesia) a median incision $1\frac{1}{2}$ inches long is made through the skin to the bone. The tip of the bone is elevated with a strong, sharp hook and the attachments of muscles and ligaments at its tip, sides and anterior surface are severed with heavy scissors. The bone is then easily detached by cutting through the sacrococcygeal joint. Any spicules at the tip of the sacrum are trimmed off. The firm bands of connective tissue which connect the rectum to the lower end of the sacrum must be preserved. The margins of the coccygeus muscle are approximated with interrupted gut sutures, then the fascia; and the skin is closed with fine silkworm gut. No dead spaces are left and perfect hemostasis is essential, otherwise blood-clots that form are almost certain to become infected. The patient rests on her side or prone and the bowels are confined for five days to prevent contamination of the wound. If infection occurs, healing is delayed and the period of hospitalization is prolonged. However, the ultimate result of excision of the coccyx is usually satisfactory.

RECTAL NEURALGIA AND HYSTERIA

Certain diseases and conditions discussed elsewhere in this work have as a prominent symptom local or reflex pain. Notable among these are anal fissure and ulcer, cryptitis and undiscovered internal fistula, papillitis, and coccygodynia. All of these conditions have been discussed under their respective headings.

Proctitis and sigmoiditis, especially the hypertrophic form, frequently produce a more or less constant sense of uneasiness in the rectum with passages of thick mucus, sometimes blood-tinged, which alarm the patient. Sigmoidoscopy discloses the true condition.

Prostatic hypertrophy in men around fifty years of age frequently gives rise to anal and rectal discomfort, although the bowel is found quite normal on examination. Several physicians have consulted me with this condition and it was only by repeated examinations at intervals that they were convinced that they were not the victims of beginning carcinoma of the rectum.

Reflex Causes.—Pain referred to the rectum has been encountered in sciatica, lumbago, diseases of the bladder or urethra; the uterus and its adnexa.

Spinal Cord Disease.—When, after thorough examination of the rectum and other pelvic organs, no organic lesion has been found to account for the pain directly or reflexly, study should be directed to the central nervous system, especially the spinal cord. Rectal pain and spasm may be among the earliest symptoms of disseminated sclerosis of the cord and tabes dorsalis. These cases are very rare. I have seen only one case of disseminated sclerosis and three of tabes in which rectal symptoms were prominent. Tabetic patients may have hemorrhoids and complain of a feeling of fullness and distention in the rectum, but if the piles are removed the symptoms persist. Paroxysmal disturbances of function of hollow viscera, usually attended with severe pain, are termed crises. In the gastro-intestinal tract, the stomach is the most frequent seat of such disturbances. When occurring in the rectum (rectal crises) the severe paroxysmal pain may be accompanied by distressing tenesmus and a sensation as of a foreign body in the rectum. The point of importance and the key to the correct diagnosis is that other definite signs of tabes are usually demonstrable, as Argyll-Robertson pupil, altered knee-jerks and swaying while standing with eyes closed and feet together (Romberg's sign).

True Rectal Neurosis.—Fortunately these distressing conditions are rare. As a rule, they belong to the field of the psychiatrist rather than the proctologist.

We have encountered three patients, all young men, possessed of the idea that offensive gases were emitted from the bowel which made them offensive to themselves and to others. Consequently they avoided society and led secluded lives.

Two patients, both women around sixty years of age, complained of excruciating paroxysms of rectal pain. In one, the most thorough search disclosed no pathology; in the other, the condition developed after operation for anal fissure,

the surgeon having made a deep incision through the levator ani in the posterior commissure. In the latter it seemed that a nerve filament might have been caught in the extensive scar. However, no relief followed when the scar was dissected out. In such cases the better plan would probably be to inject, with alcohol through the sacral foramina, the nerves supplying the parts. The greatest sympathy and tact are essential when treating patients with rectal neurosis lest they be driven to acts of desperation.

REFERENCES

- SIMPSON, Sir J. Y. "Coccygodynia and Diseases and Deformities of the Coccyx," *Medical Times and Gazette*, July 2, 1859.
YEOMANS, F. C. "Coccygodynia—a New Method of Treatment by Injections of Alcohol," *Med. Rec.*, August 22, 1914.

CHAPTER IX

FISSURE OF THE ANUS (PAINFUL OR IRRITABLE ULCER)

Fissure may be defined as a longitudinal rent of the mucocutaneous lining of the anal canal, characterized by intense pain during and after the act of defecation. No other lesion of comparable size in the gastro-intestinal tract causes an equal amount of suffering and disability. Fortunately its recognition is usually simple, and correct treatment is followed by the most happy results.

Etiology.—Fissure is a common affection constituting about 8 per cent of rectal diseases. It usually occurs in adults, but several instances have been recorded in infants from four months to two years of age. As Kjellberg found fissures in 128 of 9,098 children examined at the Stockholm Polyklinik, the

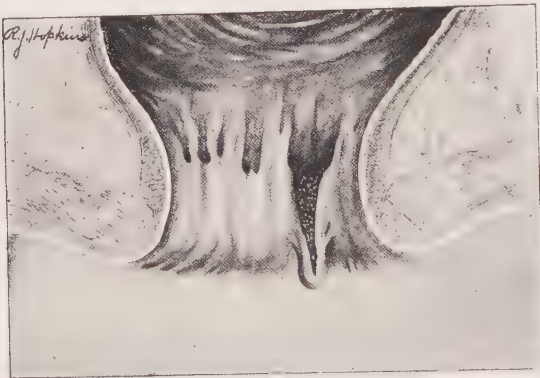


FIG. 142.—FISSURE PRODUCED BY RENT IN CRYPT OF MORGAGNI.

condition is probably often overlooked in the very young. As the anal sphincters tend to relax in advancing years, fissures are seldom encountered in the aged. About twice as many men as women are victims. The direct causes are predisposing and exciting. Predisposing to fissure is the anatomy of the anal canal, particularly its delicate mucocutaneous lining which is poorly supplied with blood; the arrangement of its muscular

supports, and a congenital narrowing of the anus. Any wound, excoriation, or inflammation of the tissues about the anus renders them friable and liable to fissure formation. Neglect of the bowel function and ensuing constipation further predisposes and fissure frequently follows parturition. The immediate exciting cause is usually trauma. The overdistention of the canal by the passage of a hard, dry scybalum or sharp foreign body, as a fishbone, lacerates the mucosa. The injury may be inflicted by the syringe tip in giving an enema, by sodomy and during prostatic massage. Hemorrhoids and fissure are frequently associated in the same patient. The same causes operate to produce both conditions but the occurrence is a coincidence and not etiological.

Location.—A fissure may be situated at any point in the anal ring. A typical fissure, however, is single and usually situated between the radiating folds at

or near the posterior commissure of the anal canal. Several theories have been advanced to explain the almost regular occurrence at this point. The most rational is that the external sphincter ani does not surround the canal in a circular fashion at the posterior commissure. Its parallel fibers run forward from the coccyx, separate at the posterior margin of the anus and pass forward to embrace the canal on each side, thus leaving an unsupported point at the posterior commissure. Moreover, the pubococcygeus portion of the levator ani gives distinct lateral support to the canal. Sir Charles Ball holds that a rent through

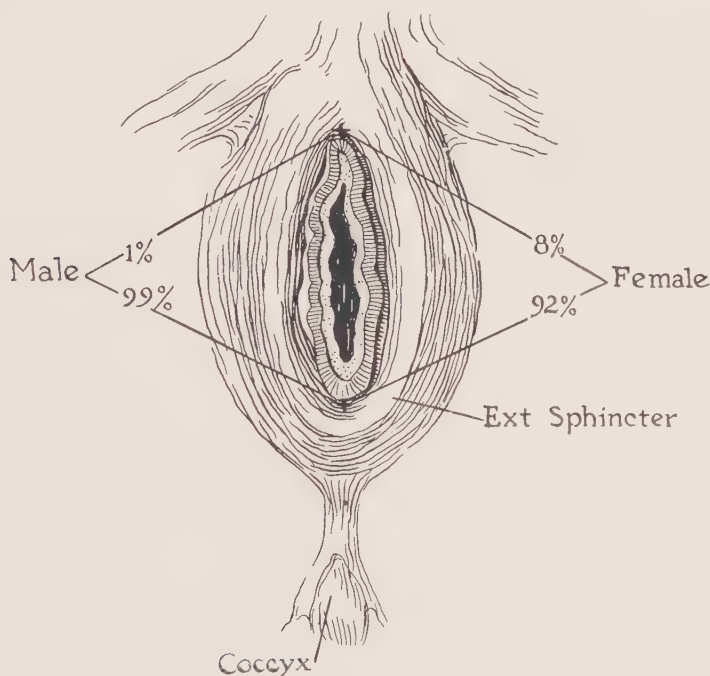


FIG. 143.—SITE-INCIDENCE OF FISSURE IN THE SEXES (PENNINGTON).

one of the anal valves situated in the anterior or posterior commissure is the starting point of fissure. While this may be true in some instances, the vast majority of fissures seen are below the level of the anal valves. In men a fissure occurs in the anterior commissure in about 1 per cent of the cases, but in women about 8 per cent are in this situation (Fig. 143). Lack of perineal support best explains the predominance in women of the anterior location. Exceptionally a patient may have an anterior and a posterior fissure. This applies particularly to women.

Of the specific fissures, the syphilitic, except the primary chancre, are usually multiple, and the tuberculous quickly develop into a spreading ulcer. Gonorrhea and chancroidal infections produce multiple fissure-like ulcerations.

Pathology.—The pathologic picture varies with the duration of the lesion. In the acute early stage, the tear is usually superficial, but may extend through

the mucosa to the sphincter muscle. Its surface is raw, margins inverted and it is not indurated. If an acute fissure is not relieved, local infection from poor drainage tends to produce a deposit of fibrous tissue and induration of its margins, which thus tend to become undermined, resulting in a so-called irritable ulcer. The elongated appearance of a fissure is due to the compression of its sides by the sphincter muscles. When the muscles are relaxed, the fissure appears as an oval or round ulcer. At the lower limit of the fissure a skin tab frequently develops as a result of the local infection. This is known as the "sentinel pile" of Brodie. In fact, this is not hemorrhoidal but its presence is a sure indication of fissure. Hypertrophied anal papillæ, hemorrhoids and the

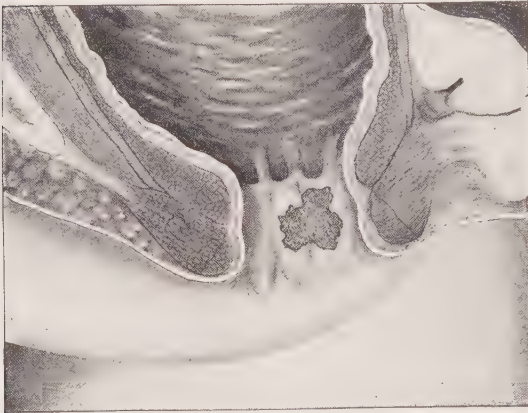


FIG. 144.—IRREGULAR FISSURE OR IRRITABLE ULCER OF ANUS.

inversion of the margins of the ulcer, by pressing on the ulcer, aggravate the pain and tend to prevent healing. Local irritation and infection set up intrafascicular changes and perineuritis in the nerves involved in a chronic fissure, resulting in spasm and hypertrophy of the sphincters, which, with the fear of pain at stool, induce or increase constipation and lead to stasis toxemia.

Extension of infection from a fissure to the adjacent tissues is a common occurrence. A complete history will demon-

strate that, in the majority of cases, a fissure or infected crypt of Morgagni was the starting point of an abscess resulting in an anal fistula.

Symptoms.—Pain is the cardinal symptom, usually excruciating in character, and disabling in its effects. It usually begins with the passage of a hard stool and lasts a variable time, even many hours, thereafter as a dull ache or throbbing. When the lesion is superficial, the pain and discomfort may pass in a few minutes to half an hour after defecation. A dull ache or throbbing, coming on some time after stool and persisting several hours, is apt to be associated with a fissure situated in the upper part of the anal canal opposite the internal and deep portion of the external sphincter. In a general way the acuteness and severity of the pain increases with the nearness of the fissure to the anal margin. A drop or two of bright blood may be passed with the stool which is frequently blood-streaked. Early spasm, and later, hypertrophy of the sphincters, together with postponed bowel action, because of the accompanying pain, establishes a "vicious circle" which aggravates the condition.

Reflex Symptoms.—Because of the close association of the nerves supplying the anal canal and the urogenital organs, fissure may cause curious and mislead-

ing symptoms. These include symptoms of dysmenorrhea, dysuria or retention of urine. Pains referred to the ilio lumbar and sciatic nerves may lead to the erroneous diagnosis of lumbago or sciatica.

Complications.—Hemorrhoids and fissure are frequently associated. The most common cause of severe pain, attributed to internal hemorrhoids, is a complicating fissure. Pruritus, due to irritation and infection of the perianal skin by the discharge, is a complication which quickly subsides with the cure of the fissure. The most serious complication is infection through the ulcer, resulting in abscess and fistula formation.

Diagnosis.—The symptoms are so typical that a correct diagnosis can usually be made on the history alone. Nevertheless, a local examination should always be made and its successful accomplishment is a tribute to the skill and gentleness of the surgeon. The left lateral position of the patient is most advantageous for the examination. The buttocks are retracted gently while the patient makes a straining effort. A "sentinel pile" is an almost invariable sign of a fissure situated immediately above it. The fissure, or at least its lower angle, can usually be seen between the radiating folds but it may be obscured by hemorrhoids or edema of the mucosa.

Digital examination is next in order to detect complicating pathology, but local tenderness and sphincter spasm may bar introduction of the finger. In such cases, before applying any lubricant, anesthetic powder blown on the ulcer produces analgesia in a few minutes, or the tissue beneath the ulcer may be infiltrated with a 1 per cent novocain solution. The gloved index finger is then well lubricated with vaselin and introduced with its pulp toward the fissure, making pressure away from the lesion. Full exposure of the fissure is obtained by the introduction of a Brinkerhoff or similar speculum, placing the slide toward the fissure. If necessary and deemed wise, the examination is completed by passing the proctoscope of $\frac{1}{2}$ inch diameter, which causes less discomfort than introduction of the finger.

In exceptionally nervous patients, especially those with a complicating abscess, who will not tolerate any examination, general anesthesia may be required, and the surgery necessary for relief should be done at the time of its administration.

Differential Diagnosis.—Two other conditions may simulate fissure in symptomatology. Chancre, the primary lesion of syphilis, closely resembles acute fis-

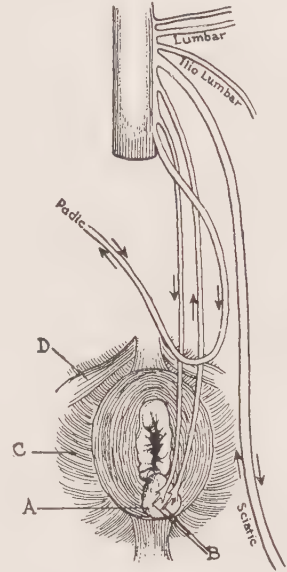


FIG. 145.—NERVES TO ANUS (DIAGRAMMATIC).

A, irritable ulcer on sphincter; B, filaments of two nerves from the spinal cord exposed on the ulcer, one sensory, the other motor, constituting an excitomotor apparatus; C, levator ani; D, transversus perinei muscle. (Hilton, *Rest and Pain*.)

sure in appearance. A reliable history is obtained with difficulty. The lesion, however, usually spreads out fanlike at the anal verge and has an indurated margin; the inguinal glands are discreetly enlarged and discovery of the etiologic *Spirochæta pallida* in the secretion from the ulcer clinches the diagnosis.

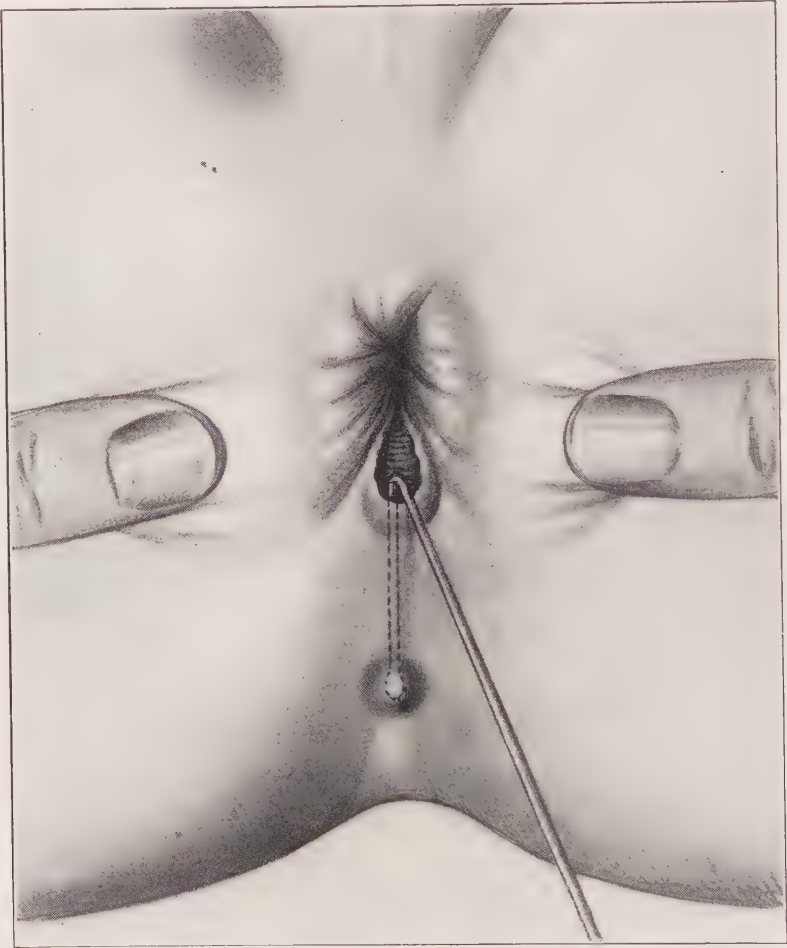


FIG. 146.—INFECTION OF TRIANGULAR SPACE THROUGH AN ANAL FISSURE.
Bent probe passed through the fistulous tract.

Epithelioma of the anus, at its onset, may present the symptoms and appearance of a chronic, painful fissure. Careful palpation, however, will detect the characteristic induration and deep infiltration of malignancy.

Treatment.—Success in the treatment of fissure rests on the application of the two principles of rest and drainage. The observance of prophylactic measures would largely prevent fissure formation. Chief among these is a regular daily habit of bowel action. The same rule applies after the fissure has devel-

oped. The mistake is frequently made of constipating the bowel. Then, when action occurs, injury and pain are very severe. The patient should eat a generous mixed but bland diet and take $\frac{1}{2}$ ounce doses of liquid petrolatum night and morning. To soften the first portion of the stool, a very practical plan is to

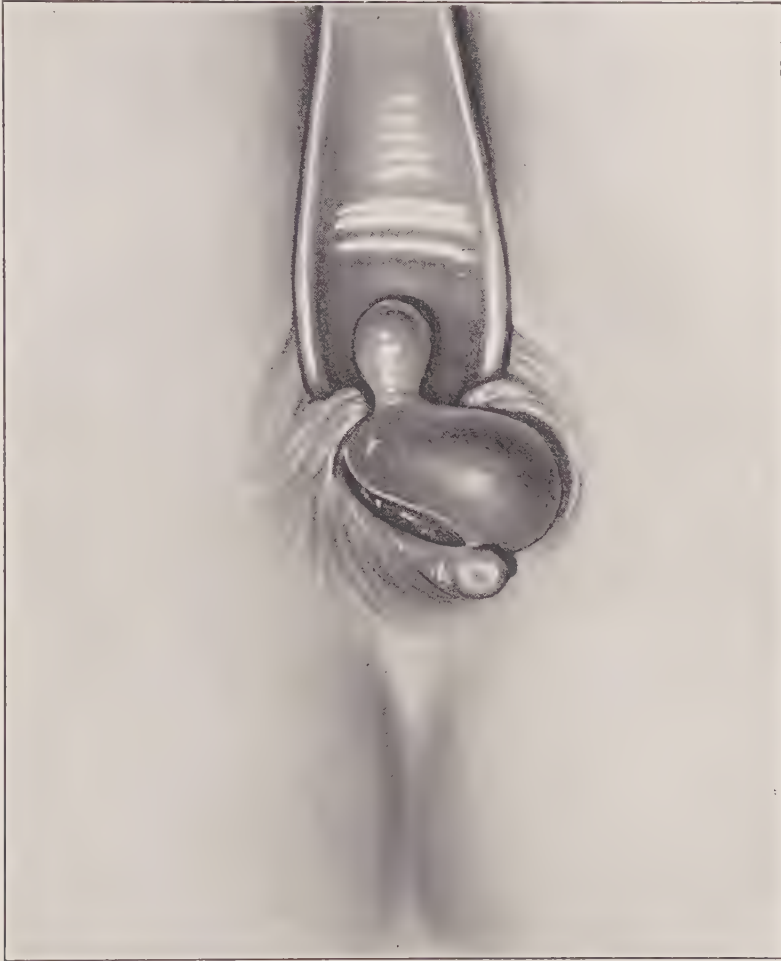


FIG. 147.—FISSURE COMPLICATING HEMORRHOIDS.

Hypertrophied anal papilla on exposed pile. Drawn at time of operation. Male, aged thirty-four.

inject from 2 to 4 ounces of warm olive oil through a soft rubber catheter a short while before the usual time for defecation. Saline and other cathartics causing fluid stools should be avoided because the excessive salts in solution and contained eliminative material act as local irritants. After each stool the parts should be sponged freely with hot water or the patient should use a hot sitz-bath of saline solution for ten minutes and then rest in the prone position

till the pain has at least partly subsided. If an acute fissure is seen within one to three days of its occurrence, it may be cured frequently by the application of pure ichthyol on a glass rod or by a small pledget of cotton, saturated with the ichthyol, placed in the fissure. When the fissure is of long standing, the ichthyol may be applied on a finger cot, the sphincters being relaxed at the same time by gentle massage. Another method, often efficient, is to make the applications through a conical speculum, warmed and lubricated with a stiff emollient jelly, but not vaselin, which prevents the medicament from coming in contact with the lesion.

Withdrawal of the slide exposes the fissure to its full extent. It is first cleansed with an antiseptic solution, dried, a 10 per cent cocain solution on a



FIG. 148.—EVERSION OF ANTERIOR FISSURE BY FINGER IN THE VAGINA.

pledget of cotton held *in situ* three minutes, followed by application of pure ichthyol; 10 per cent iodine in glycerin, 20 per cent argyrol solution, a 5 to 20 per cent silver nitrate solution, or 3 per cent silver nitrate in spiritus ætheris nitrosi. The excess of the latter is neutralized with normal saline solution. In very painful lesions orthoform powder, because of its anesthetizing properties, may be effective. Treatment is given every other day.

The probability of success by local treatment is good in recent cases without complications. A "sentinel pile" prevents drainage and so healing of the fissure. It should always be anesthetized by injecting a few drops of 1 per cent novocain solution and ablated.

Quinin and Urea Hydrochlorid Method.—In 1924, A. B. Graham reported the first use of quinin and urea hydrochlorid in thirty cases of chronic fissure, of which twenty-seven were cured. In 1926, at the Indianapolis meeting of the American Proctologic Society, he reported 128 cases of fissure so treated, and relief of 77 per cent. This is a very valuable form of treatment that can be carried out in the office by any surgeon. The patient is placed in the left lateral position, and without shaving, the skin adjacent to the fissure is painted with 3½ per cent tincture of iodine. A tuberculin or other glass syringe, fitted with a ⅝ inch, 27 gauge, sharp-pointed needle, is filled with a *freshly prepared*

5 per cent aqueous solution of quinin and urea hydrochlorid. The needle is inserted just below ($\frac{1}{8}$ inch) the lower margin of the fissure. Two minims of the solution are deposited beneath the skin and, as the needle is advanced, the solution is gradually injected, till a total of 15 minims are deposited under the fissure, the last few drops being placed just beyond the upper end of the fissure. The rationale of the treatment seems to be the isolation of the fissure by the water bed of the solution, exercising the well-known properties of quinin

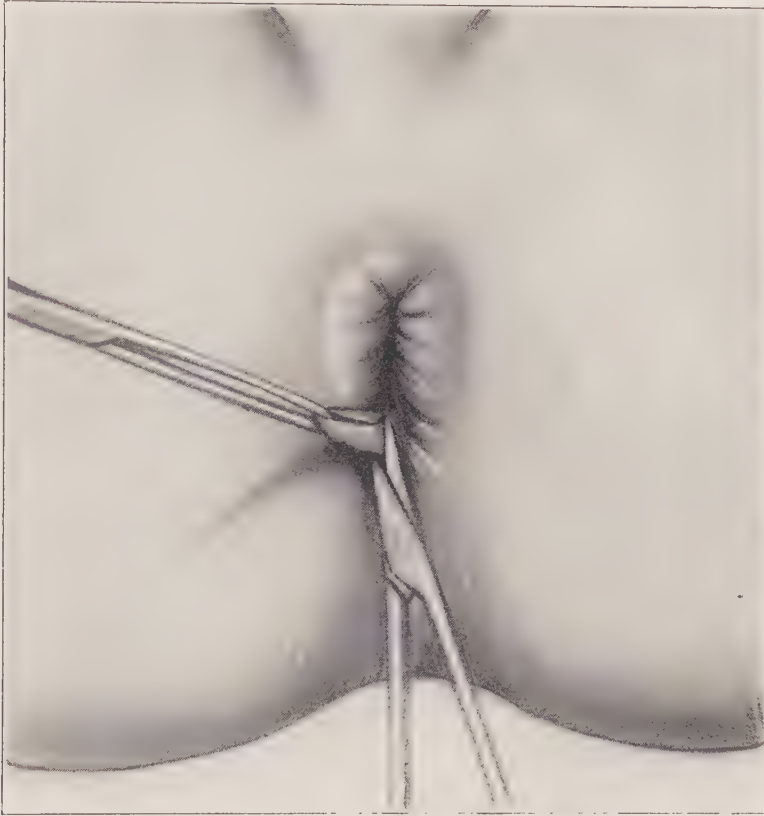


FIG. 149.—METHOD OF EXCISING FISSURE WITH SENTINEL PILE.
The latter is retracted with Allis forceps.

and urea hydrochlorid of producing a fibrinous exudate and anesthesia prolonged over several days. During the injection, which requires but a few seconds, the patient experiences rather acute, severe pain, due to the irritation of the solution. No way of preventing this pain has been found, as yet. This irritation, as well as the pain of the fissure, usually ceases a few minutes after withdrawal of the needle. A single injection may be successful but the treatment can be repeated.

The author's first experience with the treatment was in a young lady, the

wife of a physician. Otherwise she was in excellent health, but following the birth of her first child three weeks before consulting me, an acute fissure developed in the posterior commissure. The pain was almost constant and agonizing. A single treatment relieved all symptoms, the fissure healed in about ten days and there has been no recurrence to date, a period of two years. Encouraged by this experience, we used the method in a large number of fissures. In general, the results have been satisfactory or curative in about 70 per cent of the cases treated. A cure should be obtained in from two to four weeks. In our experience the treatment is indicated and usually successful in acute, recent fissures, but less reliable in the chronic type.

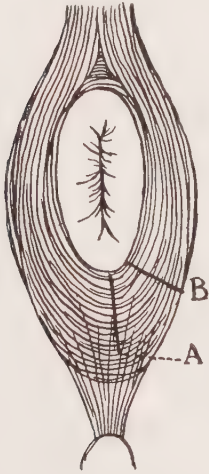


FIG. 150. — INCISION OF EXTERNAL SPHINCTER MUSCLE FOR THE CURE OF FISSURE.

A, in the posterior commissure, and *B*, just lateral to it.

Complicating pathology, especially a "sentinel pile" and hypertrophied anal papillæ, must be removed. Following the injection, the bowels are regulated, cleanliness maintained and suitable local application made, *e.g.*, 20 per cent ichthyol ointment. Recently we have found that benacol injected in the same way is equally efficient.

Surgical Treatment.—This comprises stretching or division of the sphincters and incision.

DIVULSION OF THE SPHINCTERS.—Stretching the sphincters merits consideration for it is practiced frequently in surgery of the rectum, both as a preliminary to operation and as a curative measure. Deep anesthesia is essential, obtained preferably by ether given to the point of full surgical narcosis, or by caudal and transsacral block (regional anesthesia). Chloroform is dangerous because of the deep inspiration induced by stretching the sphincters, and nitrous oxid-oxygen and ethyl chlorid do not relax the muscles. Local infiltration of the tissues with anesthetizing solutions is not satisfactory. The patient should be prepared by having the bowel emptied as for any other rectal operation. With the patient in the left lateral position, the index and middle fingers of one

hand, lubricated with soap solution, are introduced and traction is made in all directions. Then the first and second fingers of the other hand are introduced and the muscles stretched by gradual but firm pressure applied from before backward and then from side to side. Haste is dangerous as the muscle may be torn, especially in women, and rectal continence lost. The stretching should occupy from five to ten minutes. A successful stretching is evidenced by relaxation of the sphincters, the anus remaining patulous, and a tendency of the mucosa to prolapse. The mucosa should not be torn deeply but superficial rents may occur. There is slight discoloration of the perianal skin from extravasation of blood, but hematomata should not result if the stretching has been done properly. Vaseline gauze is applied to the anus and a compress retained externally by a T-binder. The patient is confined to bed twenty-four hours.

Only slight postoperative pain is experienced and the muscles regain their contractile power in two to three days. Mechanical dilators should not be substituted for the fingers, for they may damage the mucosa and rupture the sphincters. A stretching of the sphincters, properly performed, never results in rectal incontinence. This condition is due to too rapid and forceful dilatation by which the muscles are literally divulsed or ruptured, and is most apt to occur when the anesthesia is too light. It is not a true paralysis in the sense that the nerve is involved. A satisfactory divulsion will usually cure a fissure but in the chronic, indurated variety, it is our practice to excise the fissure at the same time. If a "sentinel pile" is present it is ablated, and enlarged papillæ and hemorrhoids are removed. It is important to discover any submucous tract extending from the base of the ulcer. Unless this is laid open it will persist as a suppurating sinus.

INCISION FOR THE CURE OF FISSURE.—Uncomplicated chronic fissure, with thick margins and an indurated base, or those in which the fibers of the sphincter muscle can be seen, in the depth of the fissure, or when the sphincter muscles are spastic and hypertrophied, yield promptly and favorably to incision. Local infiltration of 1 per cent novocain solution is the anesthetic of choice. With the patient in the left Sims' position, the surgeon stands with his left side toward the patient's back. Beginning 4 centimeters back of the posterior commissure, a skin wheal is raised to the anus. Then the deeper tissues are infiltrated beneath and beyond the inner end of the fissure, and including the sphincter on each side. Two opium suppositories, each 1 grain, are next inserted into the rectum. While an assistant separates the buttocks by strong traction, thus exposing the fissure, an incision is made with a sharp knife from the upper end of the fissure, through its base and straight out on the skin 3 centimeters, or more. The incision is in the midline or just lateral to it. The external sphincter is partly divided at right angles to its fibers. The extent of division necessary is determined by passing the index finger along the groove formed by the incision. This groove must be smooth and oblique and the finger slips easily into the rectum. When this condition is obtained, the surgeon is assured of good drainage and of permanent relaxation of the muscle, sufficient to prevent recurrence of the fissure.

The skin incision should be at least twice the length of the anal portion of the incision. With scissors, the margin of mucosa involved by the fissure is trimmed away, as well as the angles of the wound corresponding to the anal margin. The slight hemorrhage is controlled by holding a gauze sponge firmly in the wound for a few minutes, after which it is packed with vaselin gauze in layers, and an external compress is applied and held in place by a T-bandage or strips of adhesive applied transversely. Surgeons hold conflicting views as to the external sphincter. Some always divide it completely, others scarcely incise it at all. For several years we have followed the plan outlined with uniformly good results. The bowels are moved on the third postoperative day by

an oil enema, after which daily actions are obtained by mineral oil. Any dressing that does not come out with the first bowel movement may be loosened by peroxid of hydrogen. After the bowels have acted, the patient takes a daily sitz-bath of 1:15,000 potassium permanganate solution and a single layer of vaselin gauze is inserted as a drain. This operation may be performed in the office but for comfort the patient should be in the hospital three or four days. The wound should receive the personal attention of the surgeon until it is completely healed, which should be in about a fortnight.



FIG. 151.—FISSURE IN POSTERIOR COMMISSURE.
Lateral incision extending well beyond the external sphincter ani muscle.

An important point in the after treatment is to keep the skin portion of the wound open. Its tendency to close before the anal portion prevents drainage and delays healing.

If multiple fissures are present, all of them will heal after a single incision. A useful and at times curative measure in patients who refuse the more radical procedures of incision or divulsion, consists in running a small needle-

pointed cautery or the endotherm knife through the entire bed of the fissure. This must, of course, be preceded by local infiltration of 1 per cent novocain or a $\frac{1}{4}$ of 1 per cent quinin and urea hydrochlorid solution.

REFERENCE

GRAHAM, A. B. *J. Indiana M. Ass.*, Fort Wayne, Feb. 15, 1924, p. 50.

CHAPTER X

ABSCESS: PERIANAL, PERIRECTAL AND PELVIRECTAL

Abscesses about the anal canal and rectum are a common occurrence, constituting with their sequel, fistula, about 25 per cent of rectal affections. Abscesses developing in this region differ in no respect from those in other parts of the body but are of special importance because of the liability to fistula formation when neglected or improperly treated.

Etiology.—No age is exempt but the majority of abscesses are encountered in active adults between twenty and forty-five years of age. Recently the author operated upon an infant thirty-two days old in whom the entire ischio-rectal fossa was filled with pus (Fig. 152). Men are affected oftener than women, five to one being the ratio. This is particularly true among the working

classes who are more exposed to injury and where hygienic measures are carried out with difficulty. Diabetes and tuberculosis are predisposing factors. Stricture and obstructive cancer of the rectum are frequently complicated by an abscess. Infection may take place through the hair-follicles and sebaceous glands of the perianal skin, brought about by chafing, coarse detergent materials, horseback riding and scratching. However, infection is usually through the anorectal mucosa, the portal of entry being a fissure, ulcer, an injury, abrasion or tear—as occurs in constipation;



FIG. 152.—ISCHIORECTAL ABSCESS IN AN INFANT THIRTY-TWO DAYS OLD.

inexpert use of enema tubes, injudicious probing of fistula tracts, and rarely after rectal operations through wound infection or infection of a blood-clot some distance from the wound. Neglected strangulated, gangrenous internal hemorrhoids quickly result in abscess. Perforation of the rectal mucosa by a foreign body, as a fishbone, is not an infrequent occurrence and invariably results in abscess. An appendicular abscess may involve the perirectal spaces as may that from necrosis of the pelvic bones and vertebræ.

Rarer causes of perirectal suppuration in men are extension of infection from the urethra, prostate and seminal vesicles, and in women from the uterine adnexa. Alexander, who made a careful and extensive study of these conditions, believed that the source of infection in a perineal abscess in men is always from

the urethra: "(1) Through the glands connected with the bulbous or membranous portion, *i.e.*, the glands of the bulb, the glands of Cowper, or Littre's glands, or the prostate; and from these extends into the perineal tissues; (2) it may occur through small fissures in the mucosa of the urethra (Delbet); (3) it may be the result of more or less extensive mechanical rupture of the urethra from external or internal violence." In this view, perineal abscess is due to infection extending from the urethral glands which are coincidentally involved in prostatic abscess. Infiltration with urine may be absent but in some cases plays a prominent part. Stricture of the urethra may be present or not.

When suppuration begins above the triangular ligament, it may involve the ischiorectal fossa as well as the perineum. The pus may burrow beneath the posterior border of the triangular ligament directly into the ischiorectal fossa; or it may invade the perineum first and later, as a result of necrosis of the deep layer of the superficial fascia, extend into the ischiorectal fossa.

Morrissey has recently emphasized the importance of the connection between ischiorectal and perirectal abscess and chronic infection of the seminal vesicles, a relationship which is frequently overlooked. He states that infection begins in the tip of the seminal vesicles or in the perivesicular tissues and burrows backward and upward beneath the peritoneum, opening into the iliac fossa; or it may extend posteriorly into the postrectal space and thence invade the ischiorectal fossa, manifesting itself there as an ischiorectal abscess. He operated upon twelve cases of extensive peripelvic prostatic suppuration, all of which had developed perirectal and superior pelvirectal abscesses.

The pus-producing organisms usually found in the abscesses are staphylococci, streptococci and colon bacilli. Rarely one or the other group is found in pure culture. Usually, however, there is a mixed infection, with *B. coli* nearly always present. Although the colon bacillus is usually present, it is not necessarily the primary cause. It seems more probable that it is a complicating organism and not pathogenic. If gas escapes when an abscess is opened it is generally assumed that the abscess communicates with the bowel. This may be true or not as gas-forming organisms are not unusual in the abscess cavity. Not more than from 3 to 5 per cent of abscesses are tuberculous according to bacteriologic studies. Although authentic cases of primary tuberculous abscesses have been reported, as a rule this infection is secondary to tuberculous foci elsewhere in the body, especially in the lungs, the germs being conveyed in the swallowed sputum, or it may complicate tuberculosis of the bowel.

Pathology.—Extension of the infection is, as a rule, through the lymphatics, the distribution of which is described in the chapter on Anatomy. It is possible for infection to occur through the blood stream after traumatism or local injury. The infection is carried by the lymphatics into the cellular tissue until it is arrested in the lymphatic glands or thrombosis of the lymphatic trunks limits it to a focus in which it multiplies and destroys the tissues, causing a circumscribed inflammation and abscess. After the abscess has formed,

the pus burrows in the direction of least resistance which depends upon the situation of the abscess.

Treatment.—Rest, hot fomentations and other local measures rarely if ever abort an abscess after the infection has invaded the tissues. Some physicians still advocate palliative treatment until the tissues are liquefied and the abscess is “ripe.” This course prolongs the suffering of the patient, results in unnecessary destruction of tissue and favors the formation of fistula—an all too common sequel of abscess. Physicians are in accord on the necessity of promptly opening an abscess immediately it is detected elsewhere in the body, but often hesitate in the case of an ischiorectal abscess. The latter should be treated on the same principle as the others and at the earliest moment. Free incision and drainage is the only safe rule to minimize this disaster. When an induration, evidently inflammatory, is present, free incision will relieve the tension and provide an avenue of escape of the products of inflammation even though the process has not reached the stage of suppuration. Following the incision, hot fomentations should be freely applied and hot sitz-baths employed. The reason that fistulæ comprise such a large proportion of rectal affections is that the primary abscess is inadequately treated. As every abscess is a potential fistula, the patient should be warned of this possibility so that he will co-operate and remain under surgical care until the abscess cavity is entirely healed. Unduly delayed healing, except in frankly tuberculous cases, usually means that the abscess cavity communicates with the bowel. Some of the factors responsible for fistula following an abscess so frequently, are:

1. Delayed operation. Meanwhile the abscess enlarges, more tissue is destroyed and healing is prolonged. Pain and induration indicate incision. It is unnecessary to wait for fluctuation.

2. Inadequate incision. Frequently the physician first consulted punctures the skin only, thus drainage is obstructed and so fistula invited. To insure free drainage and a patent skin opening during the after treatment, the practical working rule is to make the incision longer than the broadest part of the abscess.

3. Incisions poorly designed. The form of incision varies with variety of abscess and the method of operating on each will be described under its proper heading. Incisions radiating from the anus, as a rule, are not satisfactory. The corrugator cutis ani and sphincter muscles tend to draw the edges together and check drainage. In general, incisions parallel to the sphincter avoid this drawback and are best.

Classification.—The anatomy of the parts determines the classification and largely the situation of these abscesses. The levator ani muscle with its fascia constitutes the pelvic diaphragm which embraces the bowel at the anorectal junction. Abscesses below the pelvic diaphragm are termed infralevator, and those above it, supralevator, deep or pelvirectal. This classification is of great clinical importance for the infralevator abscesses are comparatively superficial,

easily recognized and quickly relieved, while those above the levator are often diagnosed with difficulty and present a serious problem.

Infralevator abscesses are:

- Cutaneous
- Marginal (submucocutaneous)
- Ischiorectal

Supralevator abscesses are:

- Retrorectal
- Superior pelvirectal
- Mural (or interstitial)

INFRALEVATOR ABSCESES

Cutaneous.—Cutaneous abscesses are virtually a folliculitis or infection of the perianal skin through the hair-follicles. The inflammatory process is usually confined to the skin but, if neglected, may extend to the subcutaneous tissues. Local cleanliness is essential to limit extension. The entire area should be painted with tincture of iodine, followed, after drying, by 95 per cent alcohol. The apex of individual furuncles is scraped off with a scalpel and a fine applicator with a small bit of cotton twisted tightly at its end is dipped in 95 per cent phenol and is inserted, by a boring motion, to the depth of the infection. If possible, incisions should be avoided as they tend to spread the infection.

Marginal Abscess.—This is a circumscribed superficial collection of pus beneath the skin at the anal margin. It usually results from infection through a break in the mucocutaneous lining of the anal canal, a fissure, or may follow thrombosis of isolated internal or external hemorrhoidal veins. Its usual situation is lateral but it is often posterior in the so-called triangular space. Pain is an almost constant symptom, usually of a severe throbbing character, and aggravated by pressure, as sitting, coughing or bowel action. If the pus burrows beneath the mucocutaneous lining of the anal canal it is within the grasp of the sphincter and under considerable tension, as there is comparatively little submucous tissue in which it may spread. Both of these anatomical factors increase the pain. In general, the higher the abscess extends in the anal canal, the more severe the pain. There may be constitutional disturbances, as a chill, fever and malaise. A local inflammatory swelling soon manifests itself, usually at one side of the anus. Unless incised, the abscess opens spontaneously on the skin or through the mucosa, commonly between the sphincters, with relief of symptoms. If untreated, the same cycle is apt to be repeated and a subtegumentary fistula develop. Rarely an abscess develops entirely within the anal canal, giving no external manifestations, but when the buttocks are separated widely a globular swelling may be seen which, to the finger, is tense or fluctuating and tender. Infection of the triangular space just back of the anus is almost invariably through a fissure or ulcer in the pos-

terior commissure of the anal canal. There is usually a history of fissure, possibly of long standing, then suddenly a localized inflammatory swelling develops just back of the anus and the overlying skin is edematous. Pain is severe and tenderness exquisite. Without treatment the abscess terminates in one of three ways: Drains through the fissure, leaving a chronic sinus (blind internal fistula); or breaks through the skin, forming a complete fistula, or spreads beneath the fascia to the ischiorectal fossa of one or both sides, the latter constituting a horseshoe fistula. The spontaneous opening of an abscess in this region affords such relief that patients will often go for months or years

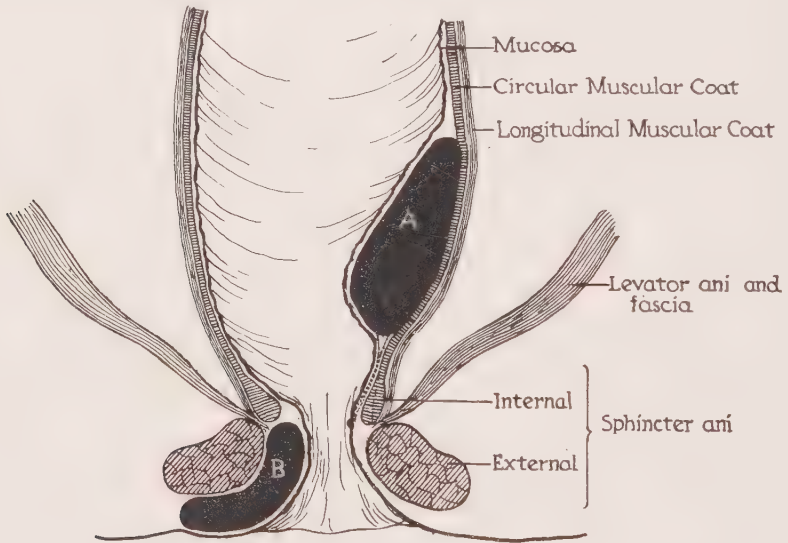


FIG. 153.—ABSCESS OF RECTUM.
A, submucous; B, marginal abscess.

without adequate treatment, suffering from intermittent discharge, which causes local moisture and irritation of the skin.

Tuberculous abscess is commonly of the marginal type. Usually its course is slow and symptoms mild. Finally there occurs a small perforation of the skin through which pale, watery discharge oozes. The condition is often in this stage when the patient applies for treatment.

Diagnosis.—The history, inspection and palpation establish the diagnosis of marginal abscess. Abscesses in this location present no difficulties. It is important to differentiate a tuberculous abscess from one due to ordinary pyogenic infection. The longer course, the appearance of the abscess, character of the discharge and usual presence of a tuberculous focus elsewhere, especially in the lungs and colon, will decide the question.

Treatment.—No special preparation of the patient is necessary. Locally the skin over and about the abscess is shaved and painted with tincture of iodine fol-

lowed by alcohol. If the skin is thin and parchment-like, it is frozen with ethyl chlorid in the line of the proposed incision. Otherwise the skin is infiltrated with 2 per cent novocain solution. Young children should be given a general anesthetic, preferably ether. A T-shaped incision is best. The first incision, with its center over the most prominent part of the abscess, is made parallel to the external sphincter; the second at a right angle from the center of the first incision (Fig. 154). The cavity is wiped dry and its surface freely swabbed with 95 per cent phenol on a cotton applicator, followed by alcohol. Then a vaselin gauze drain is inserted. A daily hot sitz-bath after defecation and dressing every second or third day make up the after treatment. The value of 95 per cent carbolic acid in the surgery of abscesses and fistulæ is not generally appreciated. After the lesion is opened and its contents evacuated, a single application of this agent to all parts of the wound surface exerts a most favorable influence. The pale, gray seared surface is succeeded by pink healthy granulations, discharge is less and the skin edges remain open longer than in wounds treated otherwise, all of which favor early healing. When dealing with a tuberculous abscess, it is preferable to make the incision and sear the cavity with an actual cautery which seals the lymphatics. However, phenol seems equally effective and the author has treated many cases by this method with most happy results.



FIG. 154.—CORRECT INCISION FOR OPENING AN ISCHIORECTAL ABSCESS: STRAIGHT AND T- INCISIONS.

Ischiorectal Abscess.—This is the most common form of abscess occurring in this region and results from infection of the poorly nourished coarse fat which normally occupies the ischiorectal fossa. Above, the levator fascia bounds the pyramidal fossa, the obturator fascia limits it externally, and the skin and superficial fascia form the base of the pyramid. The fossa is traversed by fibrous trabeculæ which localize the pus in numerous pockets.

Etiology.—The same causes which produce perianal infections are operative for ischiorectal abscess. Extension of infection from the triangular space is a common cause, and rarely a supralelevator abscess breaks through the levator ani muscle into the fossa. External traumatism may be an exciting cause. Ischiorectal abscess may occur at any age but is encountered most frequently in adult males.

The abscess is usually deep-seated at first and burrows in the direction of least resistance. If neglected, it usually ruptures into the anal canal between the sphincters, at or near the posterior commissure. Less often, it perforates the skin near the anus or at a more distant point. Due to imperfect drainage and

the entrance of foreign matter from the rectum, untreated cases may develop one or more secondary openings at any point in the anoperineal skin. The levator ani muscle practically surrounds the rectum behind, so that between it and the external sphincter the two fossæ communicate through a cellular space. The pus of one fossa frequently spreads through this space to the opposite side and this is the usual method of development of a horseshoe fistula. The abscess begins on one side but readily extends to the other, so that at operation, when there is very little external tumefaction, both fossæ may be filled with pus.

Symptoms.—Constitutional disturbance, a definite chill and fever, followed by pain in the buttock, may occur some time before frank abscess is evi-

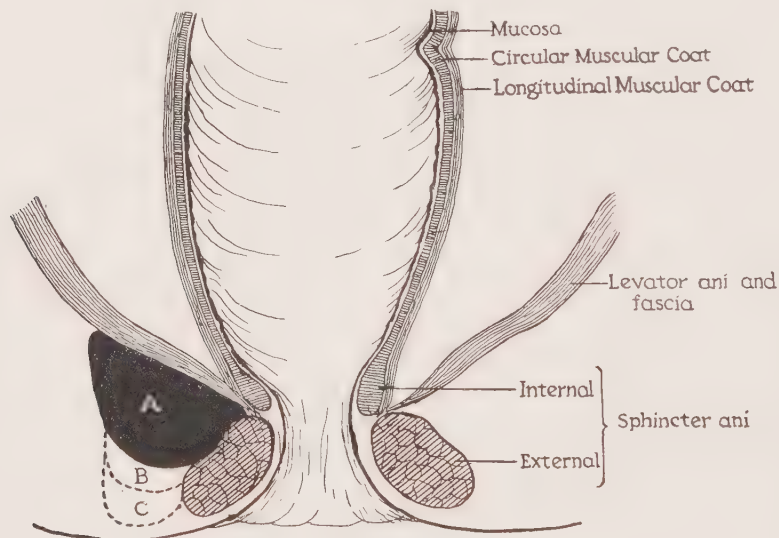


FIG. 155.—DEEP ISCHIORECTAL ABSCESS.
A, B, C, successive stages of burrowing toward the surface.

dent owing to its deep location and the abundant loose cellular tissue in which it develops. At first there may be a sense of discomfort, followed by severe pain of a dull, throbbing character. As the abscess approaches the surface, the pain is aggravated and sitting impossible. When the abscess has developed fully, the buttock is swollen, tense and brawny, back of the interischial line; the skin is livid and a point of fluctuation can usually be detected near the anus. Retention of urine is frequently associated.

Diagnosis.—Inspection suffices to recognize the fully developed ischiorectal abscess. When situated at a deeper level and there are few or no external signs, the patient should be examined in the knee-chest position which emphasizes the swelling on the affected side. Bimanual examination with one finger in the rectum may detect deep fluctuation, but the sensation usually elicited is that of an elastic, tense, tender mass between the examining fingers.

Differential diagnosis from a superior pelvirectal abscess, which has extended into the fossa, is made from the history and physical findings, especially those of rectal palpation. A large, broken-down gumma in the ischiorectal fossa in a case of the author's closely resembled a slowly developing ischiorectal abscess, but a positive Wassermann blood-test gave the clue to the correct diagnosis. Tuberculous abscess is comparatively rare, develops slowly, is not inflammatory until secondarily infected, is relatively painless, and is nearly always secondary to a focus elsewhere, usually the lungs.

The *prognosis* of ischiorectal abscess is good when treated according to the method already outlined and early surgical intervention will usually prevent a fistula.

Treatment.—Free incision and drainage is the only satisfactory method of treatment. Under 2 per cent novocain infiltration painless incision can be made, but when dealing with large or deep abscesses, general anesthesia should be used. Gas-oxygen is quite satisfactory for this short operation. With the patient in the lithotomy position, the incision is made from before backward, parallel to and outside of the external sphincter. The incision should be longer than the broadest part of the abscess, supplemented, when necessary, by a liberating lateral incision, thus forming a T. Mummery recommends a "scalping" operation whereby a disk of skin about 5 centimeters in diameter is ablated from the most prominent part of the abscess, or much larger areas of undermined skin are cut away. He uses no irrigations nor drains but a hot sitz-bath night and morning. He reports most gratifying results at St. Mark's Hospital where this method is now routine. When abscesses are present in both fossæ, the larger incision is made on the most swollen side and prolonged backward to the mid-line at the coccyx. The anteroposterior incision of the other side is shorter and the posterior raphé is not divided, even when there is free communication beneath it, between the two abscess cavities. After the pus is evacuated, the sphincter is dilated to facilitate exit of gas and feces and to guard against formation of a fistulous opening in the poorly supported posterior anal commissure. The cavities are thoroughly explored with the finger, all trabeculæ broken down and the many loculi converted into a single cavity. The light bleeding is easily controlled by the packing. The cavity is wiped dry, swabbed with 95 per cent phenol, followed by alcohol and packed with vaselin gauze or iodoform gauze wrung out in water. The packing comes away readily on the fourth day, the cavity is irrigated with boric acid solution or 1:10,000 potassium permanganate and a vaselin gauze drain inserted. Thereafter the patient takes a tub or sitz-bath daily after stool and the dressing is renewed daily for about five days, then every second or third day until healing is complete. The error of *packing* rather than *draining* the cavity retards healing and favors chronic sinus formation. A full diet is given after three days and daily bowel action is established. Rest promotes healing, but one week is the average stay in the hospital. If the abscess is tuberculous, the treatment is the same as given for tuberculous marginal abscess. Some surgeons oppose opening a tuberculous

abscess, but experience shows that draining the toxic abscess contents exerts a favorable influence on the tuberculous pulmonary focus and the general condition of the patient. If an opening in the bowels is already present when an acute large abscess is operated upon, the question arises as to whether the fistula should be incised at the same time. Some surgeons justify this procedure on the grounds that it saves the patient a second operation. The better and safer method is to drain the abscess, and when the major portion of the infection is got rid of and the cavity closing, ten days to two weeks after the primary operation, the fistula is painlessly divided under local anesthesia. It is a good plan, when incising the abscess, to insert a seton through the fistula tract, especially if it be narrow, as a guide for its subsequent division. The advantages of a two-stage operation are prevention of spread of infection to uninvolved tissues, less distortion of the parts and minimal liability to loss of control when the sphincters are divided.

SUPRALEVATOR ABSCESES

Perirectal abscesses, fortunately rather rare, are serious and present much greater difficulties than the types already discussed. They develop in the loose cellular tissue occupying the perirectal space between the peritoneum above and the levator ani muscle below. The rectum subdivides this space into a posterior or retrorectal space and an anterior or superior pelvirectal space. These spaces have been fully described in the chapter on Anatomy. This anatomical division is rather arbitrary but clinically an abscess in one of the spaces shows little tendency to invade the other.

Superior Pelvirectal Abscess.—*Etiology.*—The majority of cases in the author's practice have been in men. The etiology is often obscure. Infection may be through the rectum as an ulceration or injury by a foreign body or secondary to a rectal stricture. More often, however, it is by extension from a focus in the prostate, urethra or seminal vesicles, in males; and in the broad ligaments, in females.

Pathology.—If neglected, the abscess tends to burrow in the path of least resistance, upward beneath the peritoneum, and "point" in the inguinal region; rupture into the rectum or the peritoneal cavity, causing fatal peritonitis; rupture into the urethra or bladder, especially when complicating a rectal stricture; or rarely extend through the resistant levator fascia to the ischiorectal fossa.

Symptoms.—The symptoms may be indefinite and the true condition not suspected for some time. Usually, however, the symptoms are those of a deep-seated abscess, chills and elevation of temperature, and leukocytosis. There is a feeling of weight and pressure in the rectum, bearing down, and a desire to move the bowels. Pain may be referred to the sacrum or hypogastrium. Tenesmus and urinary retention are usual symptoms.

Diagnosis.—Digital examination detects the boggy bulging on the anterior rectal wall. Differential diagnosis is to be made especially from a prostatic

abscess, still limited to the prostate. In one of the author's early cases, a man aged thirty, all the symptoms and signs pointed to a prostatic abscess, but the catheter entered the bladder easily, drawing clear urine, which is not the case in prostatic abscess. In women, the diagnosis is much simpler than in men. A vaginal examination discloses the state of the uterine adnexa and parametrium, giving a clue to the true conditions.

Prognosis.—If unrecognized or neglected, the prognosis is grave, due to burrowing of the abscess or its rupture into the peritoneal cavity, bladder or rectum. When properly opened, early and while the abscess is still localized,

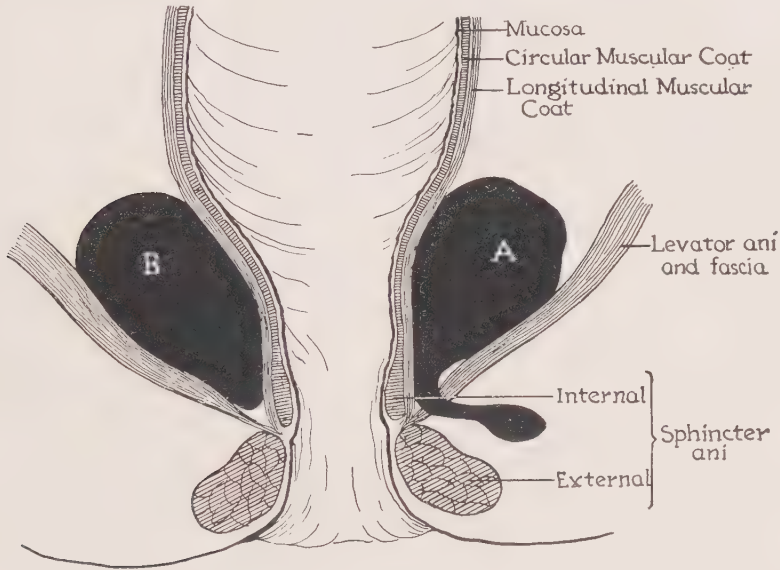


FIG. 156.—DEEP PELVIRECTAL ABSCESES.

A, perforating the levator ani muscle into the ischiorectal fossa.

the prognosis is good, although healing of the deep cavity naturally requires several weeks.

Treatment.—Surgical drainage is the only treatment, and at the earliest moment possible, once the diagnosis is made. Drainage should never be made through the rectal mucosa, as a permanent fistula is more than likely to follow. The practical rule is that any abscess that can be palpated per anum can be opened through the perirectal tissues. Drainage of superior pelvirectal and retrorectal abscesses is made through the ischiorectal fossæ. The overlying skin and tissues of the ischiorectal fossa are divided down to the levator muscle by a long anteroposterior incision. Then, with the index finger in the rectum as a guide, a long, straight bistoury is advanced until pus flows. Thereafter, blunt dissection only is used. The cavity is explored with the finger and drainage assured by dividing the fibers of the levator in a transverse direction, cutting away from the rectum, as emphasized by T. C. Hill. When the fibers of the

levator are simply separated, the opening has a tendency to close before the supralelevator cavity is obliterated. One or two large-sized drainage tubes are inserted and the pus allowed to drain, irrigations not being used until the third postoperative day. Strips of iodoform gauze are passed at the sides of the tubes to control bleeding. The tubes are shortened and finally, in about one week, vaselin gauze drains substituted. In women, the vagina may be utilized as an

avenue for drainage, a transverse incision being made through the posterior fornix (posterior colpotomy).

Retrorectal Abscess.—

Any rectal ulceration or perianal infection may secondarily involve the retrorectal space. The lymphatic glands, numerous in the mesorectum, may themselves suppurate and form an abscess. Instances are on record where an abscess in this space has followed the injection of a fistula with silver nitrate solution and the careless injection of internal hemorrhoids. Abscesses resulting from the necrosis of the pelvic bones, sacrum and coccyx, and of the vertebræ occur in this space. The possibility of the infection being tuberculous must always be borne in mind in any perirectal infection. The neglected abscess may rupture into the rectum. Very



FIG. 157.—RETRORECTAL ABSCESS.

rarely it burrows through the levator to the ischiorectal fossa, manifesting itself as a surface swelling. Exceptionally it may extend through one of the pelvic openings to appear upon the hip or thigh. For example, the author was called to see a man, aged thirty-two, of healthy constitution, who was then in a precarious condition, temperature 103° F. and suffering severe pain in the right hip and thigh. The abscess had been opened inadequately three months earlier and pus had burrowed through the obturator foramen and down the thigh outside the sciatic sheath. The buttock was swollen and tender and the entire thigh swollen and edematous. At operation, a few hours later, I passed my finger through the ischiorectal incision and obturator foramen and made a counteropening over the hip. Pus was seen to drain into this cavity from the thigh. The opening was

dilated and a large soft-rubber catheter was easily passed 9 inches. The leg and thigh were suspended at a right angle to the body. Temperature and pain subsided at once and recovery was eventually complete.

Symptoms.—The general symptoms are those of a concealed abscess but are often slight at first. There is a feeling of fullness and discomfort in the rectum, and sacral or sciatic pain may be complained of.

Diagnosis.—The index finger will usually feel without difficulty the boggy or fluctuating swelling on the posterior rectal wall. As a rule, the diagnosis is made readily on the physical findings. When there is suspicion of necrosis of

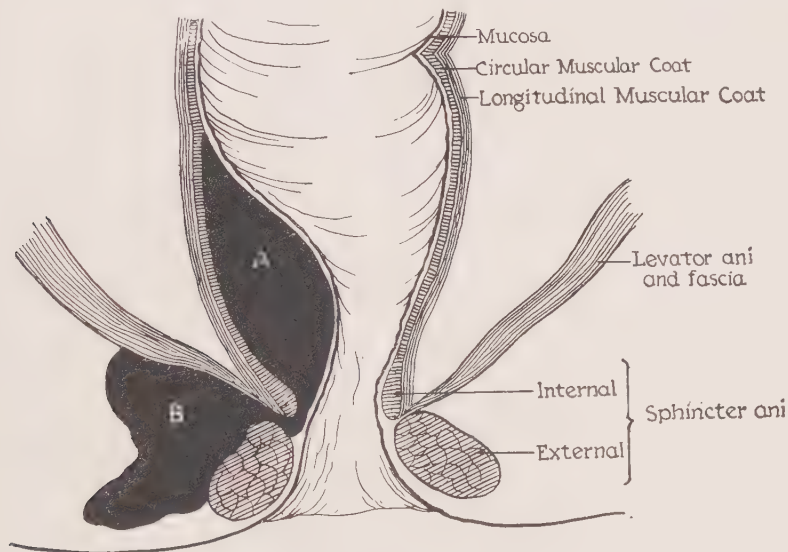


FIG. 158.—SUBMUCOUS ABSCESS (A) COMMUNICATING WITH ISCHIORECTAL ABSCESS (B) THROUGH A TRACT BETWEEN EXTERNAL AND INTERNAL SPHINCTER MUSCLES.

the pelvic bones or vertebræ, roentgenologic examination is indicated and is most valuable.

Treatment.—Most textbooks advise a crescentic incision between the anus and coccyx. We do not agree with this for the reason that the attachment of the sphincter muscle to the coccyx is divided, its efficiency is impaired and a mutilating scar results. Moreover, such an incision is unnecessary. An incision through the ischiorectal fossa of the same type as described for the superior pelvirectal abscess gives a more direct approach to the abscess, affords adequate drainage and has proved successful in all of the considerable number of cases in which the author has used it. The after treatment is practically the same as already given for superior pelvirectal abscess. An important part of the after treatment is a hot sitz-bath, night and morning, to stimulate circulation and drainage. Boiled water may be used but I prefer a 1:10,000 potassium permanganate solution.

Mural or Submucous Abscess.—Strictly speaking, this is the only abscess of the rectum proper. It occurs in the submucous connective tissue between the mucous and muscular coats of the rectum, usually in the lower 3 inches of the rectal wall. Injury or perforation of the rectal mucosa may be the portal of entry for the infection, but in view of the fact that these abscesses may drain spontaneously or by digital pressure, in the pectinate line, it seems probable that infection is usually through a crypt of Morgagni. Mural abscesses are more or less chronic and usually the symptoms are not fulminating. A fullness in the rectum, a dull ache and throbbing may occur and occasionally elevated temperature. If spontaneous opening occurs, considerable pus is discharged. In the later chronic stage there is a feeling of rectal discomfort, only slight discharge from the persistent sinus, the thickened wall of which may be felt through the mucosa. These abscesses are usually in the lateral rectal wall but they may be posterior.

Digital examination of the unopened abscess detects an oval bulging of the rectal wall, the upper limit of which can be reached by the finger. It is elastic or boggy and very tender. In one of the author's patients, a gentleman aged seventy-five, rectal touch suggested malignant infiltration but at operation the mural abscess was found to communicate, between the sphincter muscles, with an ischiorectal abscess on the same side (Fig. 158). Free incision of the external abscess and partial incision of the mural abscess, together with close personal attention to the after care, resulted in sound healing and a cure without cutting the sphincter muscle. Thrombotic internal hemorrhoids give signs much the same as mural abscesses, but there is no rise of temperature unless infection supervenes.

Treatment.—Some writers advise that when the abscess opens spontaneously at the pectinate line it should be kept under observation, as half of them will heal without interference. The author's experience does not accord with this teaching. To secure complete healing without a submucous, suppurating sinus the mucosa must be divided the full length of the abscess. The operation is performed within the rectum. The sphincters are dilated and a rectal retractor introduced on the side opposite the abscess. The mucosa is incised the full length of the abscess cavity and part of its margins pared off with scissors to prevent undermining. Bleeding may be troublesome but controllable by long clamps, applied temporarily, followed by packing the wound tightly with dry gauze and inserting a large tube into the rectum, well above the incision. The packing should remain in place four days and after its removal the rectum is irrigated twice daily with hot 1:10,000 potassium permanganate solution. The wound need not be packed again but the gloved finger freely smeared with ichthyol ointment should be passed every third day to smooth out the tract.

REFERENCES

- ALEXANDER, Samuel. *Med. Rec.*, Oct. 28, 1905.
MORRISSEY, J. H. *Surg., Gynec. & Obst.*, March, 1928, Vol. 46.

CHAPTER XI

FISTULÆ

SIMPLE FISTULÆ AND TUBERCULOUS FISTULÆ

The subject of fistula merits detailed consideration, as it comprises about one-fourth of the cases of rectal surgery, is largely a preventable condition, and adequate treatment usually results in cure, while careless handling is frequently followed by recurrence. As the term is used in proctology, an anorectal fistula is a pathologic communication between the skin and the anal canal or rectum. Such a canal constitutes a complete fistula. When the tract has an orifice at one end only, it is termed an incomplete fistula. Long usage sanctions the term "blind internal fistula" to describe an incomplete fistula, or what is really a sinus, opening into the anorectal region but having no skin orifice; and "blind external fistula" for an incomplete fistula opening on the skin only. This is a simple description of fistulæ. Successful treatment of fistula depends largely upon locating the internal opening, the situation of which forms the practical basis of clinical classification. Classified according to the anatomical location of their internal opening (Pennington), fistulæ are: *Anal*, opening in the anus; *anorectal*, opening at the pectinate line between the sphincters; or *rectal*, opening through the wall of the rectum proper.

Etiology.—The vast majority of fistulæ occur in the third to fifth decades of life, although the extremes of age are not exempt. Children are not infrequently affected. The author has operated upon a complete fistula in an infant of seven weeks and in another of six months. In the former an abscess had been opened one week after birth. The possibility of injury during parturition naturally suggests itself as being the etiological factor in these very young patients. A fistula almost invariably results from a neglected or inadequately treated abscess, the causes of which have been stated in the chapter on Abscess. Tuberculosis, syphilis and traumatism are predisposing factors.

Pathology.—The life history or development of a fistula, in the majority of cases, is in the following sequence: Passage of a hard constipated stool or straining, causes an abrasion or fissure of the anorectal mucosa; infection, through this breach, of the cellular tissue beneath the mucosa and adjacent to the bowel; abscess formation; rupture of the abscess on the skin surface, into the bowel, or often in both directions, the contracted wall of the abscess cavity forming the fistulous tract. The established fistula is a suppurating canal, lined with granulation tissue; its wall composed of dense fibrous tissue. Chronicity is the characteristic feature of a fistula. Anal fissure in the posterior commissure

is doubtless the most common precursor of a fistula. Infection through the fissure results in an abscess in the triangular space back of the anus. This may drain through the fissure and persist as a chronic suppurating sinus, but it

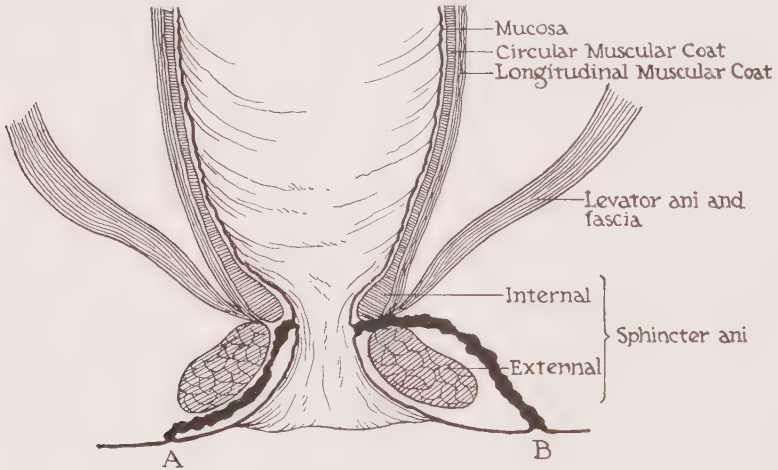


FIG. 159.—FISTULA.

A, complete subcutaneosubmucous fistula; *B*, complete fistula in ano.

frequently breaks through the skin in or near the midline, forming a subcutaneous fistula. In other instances the infection and resultant abscess spread to the ischiorectal fossa of one side but frequently involve both fossæ. The

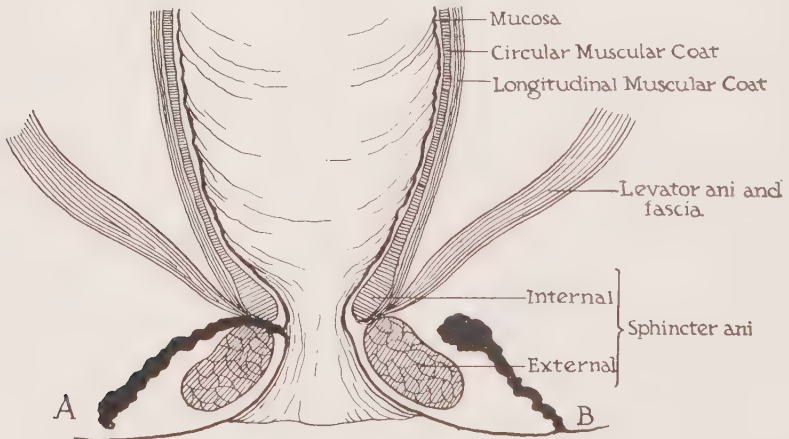


FIG. 160.—*A*, BLIND INTERNAL FISTULA. *B*, BLIND EXTERNAL FISTULA.

abscess may drain incompletely through the fissure (blind internal fistula) or perforate the skin on one or both sides, thus forming a posterior horseshoe fistula. The epithelium of the skin or mucosa, at the extremities of the fistulous tract, is prone to close over and seal the opening. Then the discharge accumu-

lates, inflammatory symptoms of a recurrent abscess develop, and the abscess opens through an original orifice or breaks through the tract and perforates the skin at a new point. This is the mechanism of formation of multiple external openings, although there is usually only a single aperture within the bowel.

The only tissues of the ischiorectal fossæ resistant to infection are its limiting fasciæ—the anal above and the obturator externally. As a consequence the abscess cavity ramifies in various directions in the fatty-cellular tissue and when it is evacuated, contraction of the walls of the abscess cavity results in a tract that is deviating and tortuous.

It is easy to understand why a complete or blind internal fistula does not heal. Feces or gas pass into or through the tract from the rectal side, constantly



FIG. 161.—EXTERNAL OPENING OF SUBTEGUMENTARY FISTULA.

reinfesting it. Just why a blind external fistula does not heal is more of an enigma. More or less constant movement of the parts in respiration, sphincter action and pressure are advanced as causes. Even when the tract is opened freely to its full depth, recurrence may occur. The true explanation of non-healing in the majority of cases, is, in the author's opinion, the presence of a minute, undetected portal of infection in the bowel mucosa; or, in a few instances, a tortuous tract that does not drain.

Tuberculous Fistula.—The vast majority of fistulæ are due to a simple infection, *i.e.*, the cocci and bacilli ordinarily composing the intestinal flora. Formerly it was believed that over 40 per cent of fistulæ were tuberculous. Careful histologic study and inoculation of animals demonstrate that 15 per cent more closely approximates the correct figure. Gabriel of St. Mark's Hospital, London, studied seventy-five consecutive cases histologically and by inocu-

lation of guinea-pigs with prepared material from the scrapings and finely divided portions of fistulous tracts. He concluded that 20 per cent of this series of seventy-five cases was tuberculous. Search of the discharge from a fistulous tract for tubercle bacilli is unreliable and useless. Statistics from hospitals and sanatoria for the tuberculous show that fistula is a complication in about 6 per cent of cases of pulmonary tuberculosis. Of course, a simple fistula may develop in a victim of pulmonary tuberculosis. While most tuberculous fistulæ are secondary, a primary focus elsewhere cannot be demonstrated in every case. Infec-

tion is usually from swallowed sputum or through the blood stream. In the primary cases, infection is probably through the bowel mucosa. Supporting this view is the fact that tubercle bacilli have frequently been isolated from the normal feces in non-tuberculous individuals.

Symptoms.—After the fistula is established as a chronic suppurating channel, there is a more or less constant purulent discharge which irritates the skin and usually requires wearing of a protector. In some cases the discharge is very slight but in the variety with multiple external openings ("watering pot" fistula) and undermining of the skin, the discharge is profuse, of foul odor and the skin highly inflamed. As long as a fistula drains perfectly, pain is not a prominent symptom. There is, however, usually a feeling of discomfort. In a complete or a blind internal fis-

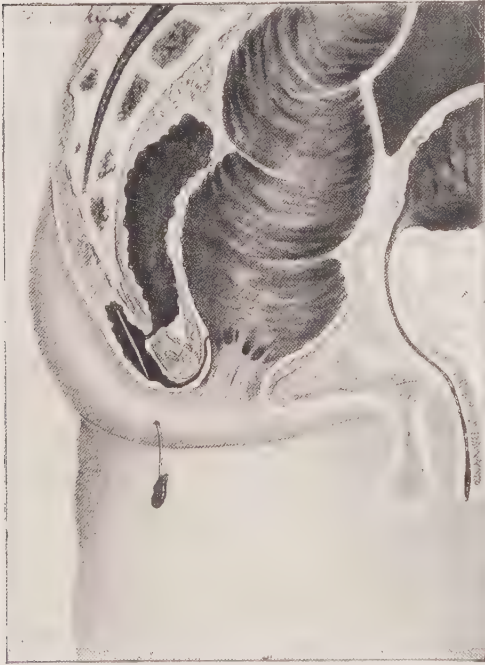


FIG. 162.—SUBTEGUMENTARY FISTULA INVOLVING ISCHIORECTAL AND RETRORECTAL SPACES.

tula, the pain and discharge depend largely on the size of the internal opening and the consistency of the feces. Given a large opening and liquid feces, the pain and discharge are marked. On the other hand, a blind external fistula may be comparatively symptomless, until its opening becomes sealed by the epithelium growing over it, as it is prone to do. Then the symptoms of a recurrent abscess develop, which opens into the rectum or perforates the skin at a new point. Associated with the discharge is an offensive odor which may be one of the chief causes of complaint.

Diagnosis.—As a rule, the diagnosis of a fistula is simple and accurate. There is nearly always the history of an abscess that has burst or been incised. A small, elevated papilla, a cicatricial depression or slit in the skin, or in the

scar of a former incision, is the site of a minute or larger external opening from which a drop of pus can be expressed. A cordlike tract can usually be felt, running from this point toward the anus. The index finger in the anal canal may feel the internal opening as an ulcer, or as a cicatricial depression in the anal canal, usually between the sphincters, and sometimes as an elevation somewhat higher up. In about 90 per cent of cases the internal opening is in or near the posterior commissure. The situation of the opening between the sphincters is often more apparent than real, the thickening of the tissues, mistaken for the

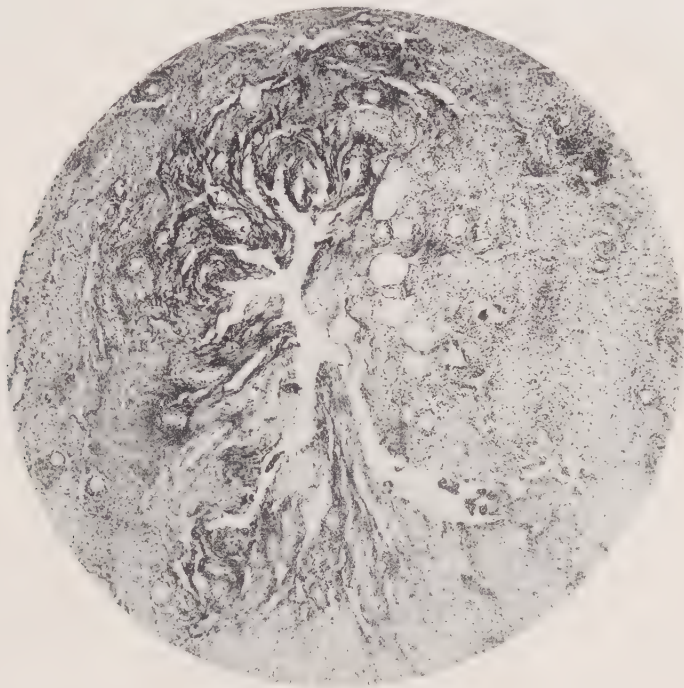


FIG. 163.—PHOTOMICROGRAPH OF TRANSVERSE SECTION OF TRACT OF RECTAL FISTULA EXCISED INTACT.

sphincter, being in reality the indurated wall of the fistula. A flexible probe may be passed readily in some cases of complete fistula with a straight tract. The probe, however, fails in many simple and in most of the complex cases, causes needless pain, and persistence in its use may produce false passages.

Diagnosis by Injections.—The simplest, safest and surest way as yet suggested of demonstrating the presence of a complete fistula is to inject a staining fluid through the tract. The best agents for this purpose are a saturated solution of potassium permanganate or methylene-blue. I use two parts of methylene-blue and one of peroxid of hydrogen, as suggested by Lynch. The technic is as follows: A nasal applicator, wound tightly with cotton and smeared with vaselin, is inserted 3 or 4 inches into the rectum. Then a 10 c.c. all glass

syringe, tipped with the conical butt of a large gauge hypodermic needle and charged with the methylene-blue-peroxid solution, is inserted into the external opening. The syringe is held firmly for a few moments while light pressure is made on the piston. The gas, liberated by the peroxid in contact with the discharge, quickly carries the methylene-blue to all ramifications of the tract, and through the internal opening, if one be present. The fluid frequently bubbles at once through the anal orifice or appears as a blue stain on the applicator. If only a few drops of the fluid entered the bowel, the position of the stain on the applicator indicates fairly accurately the situation of the internal opening. Another useful method of determining the location of a high internal opening is to introduce a Sims' speculum into the rectum, on the side opposite the



FIG. 164.—HORSESHOE FISTULA.
A, anterior; B, posterior to anal canal.

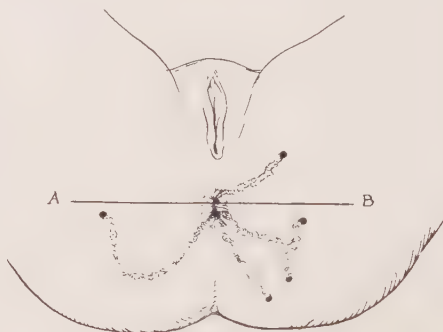


FIG. 165.—BELOW LINE (A-B), MULTIPLE FISTULOUS TRACTS WITH COMMON OPENING IN POSTERIOR COMMISSURE OF ANAL CANAL. ABOVE LINE, FISTULA WITH INTERNAL OPENING IN ANAL CANAL DIRECTLY OPPOSITE EXTERNAL OPENING (SALMON'S LAW).

fistula, and observe the point of escape through the mucosa of the staining fluid injected. Complex fistulæ, with multiple and tortuous tracts and especially those with no demonstrable internal opening, should be injected with 10 per cent bismuth paste, to outline their course, and stereoscopic roentgenograms taken, to aid in the plan of treatment.

Salmon's Law.—As a general but not infallible rule, when the external opening of a fistula is within 5 centimeters of the anus and anterior to a transverse line crossing the center of the anus, the internal opening is radially opposite. On the other hand, most fistulæ with external openings posterior to this line or more than 5 centimeters from the anus anterior to the line, have their internal opening in the posterior commissure of the anal canal.

Blind Internal Fistula.—A blind internal fistula has a history of constant or intermittent discharge from the rectum. By separating the buttocks, while the patient strains, pus frequently oozes out. The internal opening can usually be felt in the anal canal and a bent probe can be passed into the tract directly or after a speculum of the Brinkerhoff type has been introduced.



FIG. 166.—HORSESHOE FISTULA IN BOY AGED FIVE MONTHS.



FIG. 167.—X-RAY OF HORSESHOE FISTULA IN MALE, AGED THIRTY-TWO YEARS, INJECTED WITH BISMUTH PASTE.

Blind External Fistula.—A blind external fistula presents one or more external openings but no internal opening can be demonstrated by palpation, probe or injection. However, this may be deceptive as the internal opening may be only temporarily sealed, and examination, at a later date, reveals a small internal orifice, as the author has found in a number of cases.

Tuberculous Fistula.—It is of the greatest importance to recognize a tuberculous fistula, both for the prognosis and method of treatment, which differs essentially from the treatment of a simple fistula. The majority of fistulæ in tuberculous subjects are tuberculous but this is not an infallible rule. Locally a tuberculous fistula usually presents a characteristic appearance. The margin of the fistulous opening is uneven, thin and undermined and frequently shows a tendency to spread. The granulations are indolent and unhealthy and the scant discharge is pale and watery. Neither the discharge nor the scrapings from the tract of the fistula may show tubercle bacilli under the microscope. The history and local appearance are the most reliable guides for the diagnosis. In doubtful cases the safest rule is to assume that the fistula is tuberculous.

Prognosis.—In general, the prognosis of fistula is ultimately good. This is stated in spite of the fact that a large percentage of those operated upon are not cured and that the majority of the cases referred to the specialist have been operated upon from one to three or more times. The reasons why operation for fistula fails so often are:

1. Failure to find the pathological internal opening.
2. Failure to discover and open freely collateral tracts.
3. Neglect in after care, with resultant bridging over of the wound instead of firm healing from the bottom.

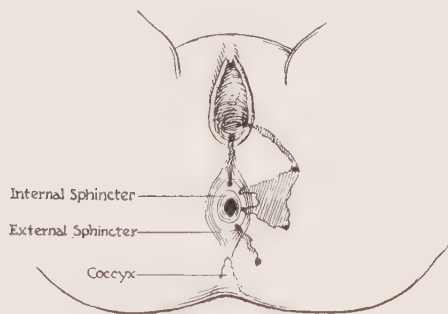


FIG. 168.—MULTIPLE FISTULÆ.
Female, aged thirty-four (diagrammatic).

Every anorectal fistula due to simple infection operated upon by correct technique and receiving regular and proper postoperative care should be cured.

Tuberculous fistulæ are in another category. When the fistula is localized and care is taken to preserve the natural barriers surrounding it, the operative prognosis is good. If there is extensive tuberculous infiltration, palliative measures only, to establish and maintain drainage, are advisable.

Treatment.—The treatment of fistula is essentially surgical. Palliative measures are rewarded with so little success that, as a rule, they deserve scant consideration. Spontaneous healing of a small simple fistula has been observed but is a very rare occurrence. Fear of incontinence deters some patients from undergoing an operation. The palliative measures are of two sorts. In one, the

purpose is to maintain drainage by dilatation or incision of the external opening and employ hot sitz-baths. The basic principle of the other palliative method is to destroy, by chemical agents, the unhealthy granulation tissue lining the tract, with the formation of firm fibrous tissue which gradually obliterates the sinus. Chemicals that have been employed for this purpose are silver nitrate, 95 per cent carbolic acid and 7 per cent tincture of iodine. Obviously the blind external fistula and complete fistula with a straight tract, especially if they are of comparatively recent development, are the only types suitable for this form of treatment. Goodsell recommends a saturated solution of

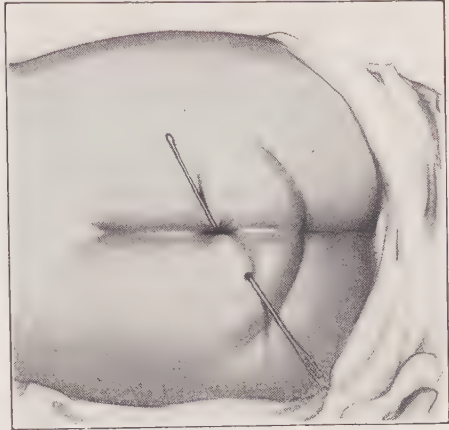


FIG. 169.—COMPLETE FISTULA.

Probe passed through tract and brought out through anus. Infant seven weeks old. Fistula followed abscess which was opened on fourteenth day after birth.

silver nitrate, which will cure some cases. Preceding the injection, olive oil must be instilled into the rectum. The treatment is painful, is temporarily followed by increased discharge and usually must be repeated in a week or ten days, depending upon the local reaction as shown by the appearances.



FIG. 170.—STRAIGHT TUBULAR FISTULA PASSING DIRECTLY THROUGH EXTERNAL SPHINCTER.

Drawn from postmortem dissection.

Bismuth Paste.—Beck's paste consists of one part of bismuth subnitrate in two parts of sterile vaselin. The paste is liquefied over a water-bath and injected with a glass or metal syringe which fits the opening snugly. If there are several openings, the others are guarded by compresses so that the paste reaches all branches of the fistula. Application of an ice-bag hastens the congealing of the paste. The theoretical rationale of the treatment is gradual hydrolysis of the bismuth with slow liberation of nitric acid which acts as an irritant. Some successes and

many failures have followed this method of treatment. It is most suitable for fistulæ of the blind external type. The injections are repeated at inter-

vals of three or four days. If no improvement is evident after a few injections, failure may be predicted.

Elastic Ligature.—This is an ancient method for the treatment of fistula seldom resorted to by the surgeon of the present day. It is the most certain of the non-operative measures, but is of very limited application. A straight



FIG. 171.—BLIND EXTERNAL FISTULA POSTERIOR TO RECTUM INJECTED WITH BISMUTH PASTE.

Male, aged fifty-two years.

fistulous tract without branches is the only type suitable for the ligature. The severe constant pain it produces is its great disadvantage. To minimize the pain, the skin, which is highly sensitive, overlying the fistulous tract should be cut, under local anesthesia, from the external opening to the anus, to form a sulcus for the ligature. Also the tissues embraced in the ligature should be infiltrated with a 1:300 solution of quinin and urea hydrochlorid which exerts a prolonged anesthetic effect. Advantages claimed for the method are that no anesthesia is required, there is no hemorrhage, and healing of the wound as the ligature cuts through. With modern operative technic the advantages originally ascribed to the ligature are no longer upheld. The only indication for an elastic or other ligature in the present-day treatment of fistula is in the few



FIG. 172.—X-RAY OF TORTUOUS FISTULA INJECTED WITH BISMUTH PASTE.
Probe in anal canal and rectum as a guide.

cases which have their internal opening above the internal sphincter, as in these it minimizes the chance of incontinence. A small round cord of solid rubber is the best material. A thread in the eye of a probe is attached to the ligature which then follows the probe through the tract of the fistula and out of the anus. The ligature is tied snugly or fastened by a perforated shot. The time required for the ligature to cut through varies with the bulk and character of the tissues embraced by it. A week to ten days is the average period.

Operative Treatment.—The three methods of operating upon fistula are incision, excision, or excision and immediate suture. Preparation of the patient

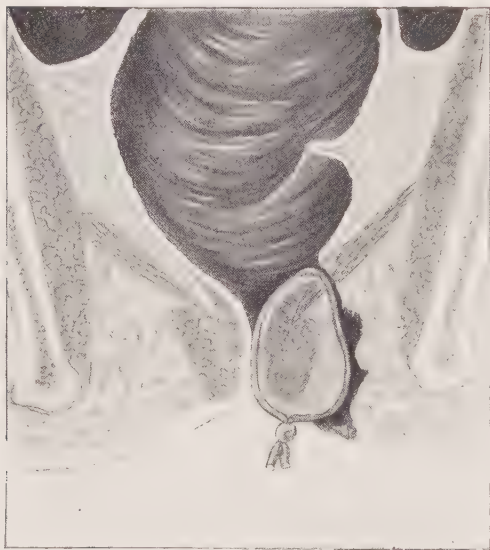


FIG. 173.—LIGATURE PASSED THROUGH FISTULA AND SECURED.

is important. The bowels should be thoroughly evacuated for they may have to be confined several days after operation. The skin should be shaved carefully and made as sterile as is possible. When practicable, the tract should be syringed daily with an antiseptic fluid during the week prior to operation, to reduce the discharge and infection. This is particularly desirable if the operation of excision with immediate suture is contemplated. Local infiltration anesthesia suffices for simple straight tracts but sacral block is required for more complicated cases. The presence of considerable discharge contra-indicates sacral anesthesia as there is too great risk of the needle carrying infection through the skin. In all complicated

fistulæ, actively suppurating, general anesthesia is most satisfactory from every standpoint. Unless stereoscopic x-ray photographs have been taken, after injecting the fistula with bismuth paste, the surgeon does not know in advance



FIG. 174.—LARRY'S GROOVED DIRECTOR.

of operation the extent of the ramifications of the tracts in a complex fistula. Unless every tract is opened to its full extent, recurrence is inevitable. Hence the necessity of complete anesthesia that the surgeon may not be hampered in his work. Nitrous oxid oxygen or ether are most satisfactory for complex cases having much discharge.

INSTRUMENTS.—In addition to a speculum of the duck-bill type and the usual forceps, there should be provided a syringe, a number of long probes, and

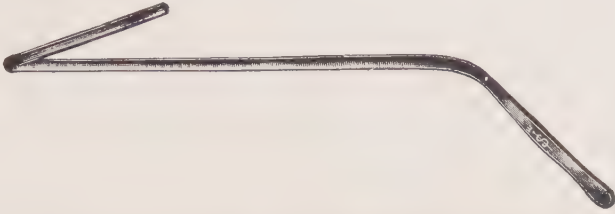


FIG. 175.—MURRAY'S RECTAL DIRECTOR FOR BLIND INTERNAL FISTULA.

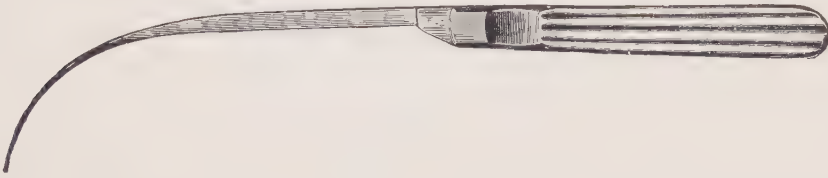


FIG. 176.—KELSEY'S FISTULA KNIFE WITH SILVER PROBE POINT.

both flexible and rigid; grooved directors with and without probe points, and curved fistula knives, with blunt and sharp tips.

POSITION.—When operating under local anesthesia the lateral position is most comfortable for the patient who lies on the same side as is the fistula. If general anesthesia is employed, the lithotomy position is most advantageous.

EXCISION OF FISTULA AND IMMEDIATE SUTURE.—This method has very limited application. The difficulty of obtaining primary healing in a chronically infected field is obvious. It is chiefly applicable to a straight tract with scant discharge. In women it is indicated where division of an anterior fistula would involve both the sphincter vaginae and external anal sphincter, with risk of relaxation of the outlet of both the cavities they guard. Excision and suture may also be attempted in the exceptional case where the fistula has a lateral opening above one or both sphincters, the division of which at this site is especially liable to be followed by incontinence. In per-

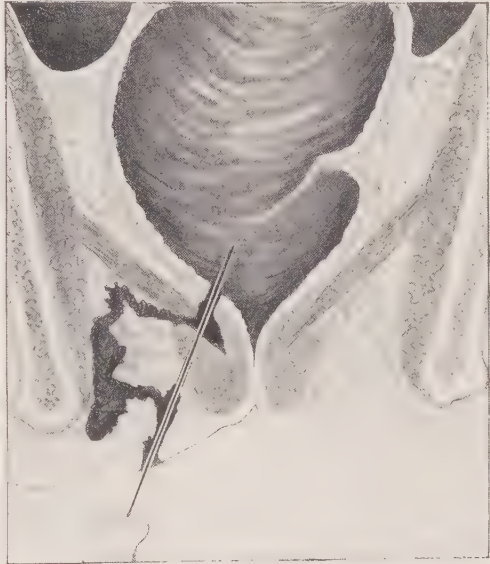


FIG. 177.—DIRECTOR PASSING THROUGH INTERNAL AND EXTERNAL OPENINGS OF FISTULA AND LEAVING PART OF TRACT UNTOUCHED.



FIG. 178.—GROOVED DIRECTOR PASSED THROUGH FISTULOUS TRACT AND SHOWING HOW PASSING A BISTOURY ALONG THE GROOVE AND CUTTING OUTWARD WILL DIVIDE THE SPHINCTER OBLIQUELY.

ting through healthy tissues at a safe distance from the tract. Great care is taken not to cut through the wall of the fistula which is excised intact, including a good margin of normal tissue at each extremity. Complete hemostasis is obtained by artery forceps, temporarily applied, and compression with gauze for a few minutes. The wound is closed without drainage by interrupted sutures of silkworm gut, using the Stewart stitch. The long, curved needle is passed about $\frac{5}{8}$ inch from one margin of the wound, completely encircling it, and emerges at a corresponding point on the opposite side. In its return, the needle takes in only the skin margins of each side. After all the sutures are placed they are tied over rubber tubing or iodoform gauze, completely closing the wound without traversing it.

forming the operation strict asepsis and antisepsis must be observed. The tract is syringed through with a saturated solution of methylene-blue, followed by 95 per cent phenol and finally alcohol. The perianal skin is painted with tincture of iodine. The rectum is sponged dry and iodine applied around the internal opening. No irrigations are used, as an enema should have been given and the rectum irrigated five or six hours before the operation. A probe is passed through the fistula and its tip brought out of the anus so that the tract is threaded on the probe. The overlying tissues are incised to, then around, the tract, always cut-



FIG. 179.—FISTULA LAID OPEN OUTSIDE OF SPHINCTER SO THAT THE LATTER CAN BE CUT SQUARELY ACROSS.

Thus no foreign body of any sort is left in the wound nor do any sutures traverse it. The bowels are confined for one week by dietary control which is much more comfortable for the patient than liberal diet and drugs to check peristalsis. Articles allowed are water, tea, coffee, broths, gelatin jellies, and an occasional piece of toast and soda biscuit. The sutures are removed on the eighth day, but if signs of infection develop, the sutures are removed at once and the wound treated as if simple incision had been done. In a number of cases of fistula of the types indicated the author has obtained primary healing of the wound and an ideal result.

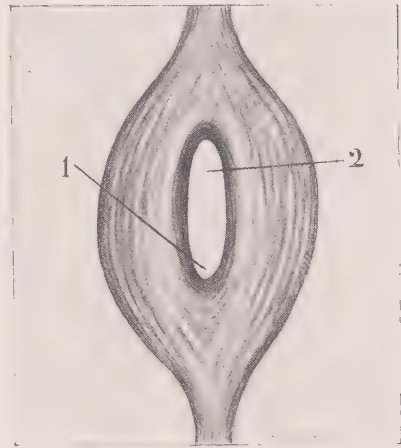


FIG. 180.—(1) OBLIQUE INCISION OF SPHINCTER WHICH IS FREQUENTLY FOLLOWED BY INCONTINENCE. (2) TRANSVERSE INCISION NOT LIKELY TO RESULT IN SAME.

INCISION AND EXCISION OF FISTULA.—Apart from the exceptional case in which excision with immediate suture is performed, excision of the fistulous tract is seldom practiced at present. Removal of all the cicatricial tissue leaves a large, gaping wound which heals by the formation

of more scar tissue and deformity of the parts. The consensus of surgical opinion favors incision.

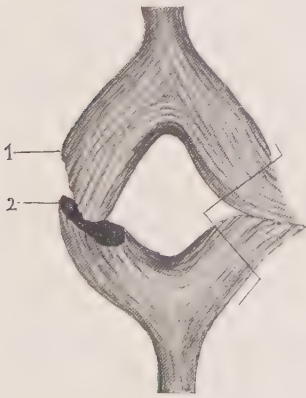


FIG. 181.—ON THE LEFT IS SHOWN THE SEPARATION AND LENGTHENING OF THE MUSCLE (1 TO 2) DUE TO OBLIQUE INCISION. ON THE RIGHT IS SEEN THE VICIOUS UNION OF THE FIBERS AND THE LINE OF INCISION FOR REPAIRING THE MUSCLE.

Incision of fistula, to be successful, must lay open the main tract and its pathological opening within the bowel, and every collateral branch. The technic is exacting. The main tract is injected with a staining fluid, a probe-pointed director passed through it and brought out of the anus, and the intervening tissues severed with a curved bistoury. If there are multiple external openings, they practically always communicate with the main tract although there is usually only one internal opening. Each collateral tract is opened in the same way into the main tract. The margins of the wound are caught in Allis forceps and retracted and any channels discovered that have not perforated the skin are freely incised. Some surgeons curet the incised tracts and others make multiple incisions through them to increase the blood supply and stimulate healing. The simplest, safest and most practical way to reach and remove the pyogenic

membrane lining every portion of the tract is the application of 95 per cent phenol, followed, in one minute, by alcohol. The overhanging margins of the



FIG. 182.—FIRST STEP IN EXCISION OF FISTULA.



FIG. 183.—REMOVAL OF A FISTULA THREADED UPON A PROBE.
Ordinarily dissection is from without inward.

wound are cut away freely, leaving no irregular angles or islets of skin. This applies particularly to the outer portion of wound where good drainage is essential until the inner part is healed. Good drainage promotes healing and leaves a smaller scar. If there is much bleeding, the wound is packed with sterile gauze. Usually the slight hemorrhage is easily stanchied by inserting strips of vaselin gauze in superimposed layers, which is the preferable method. A

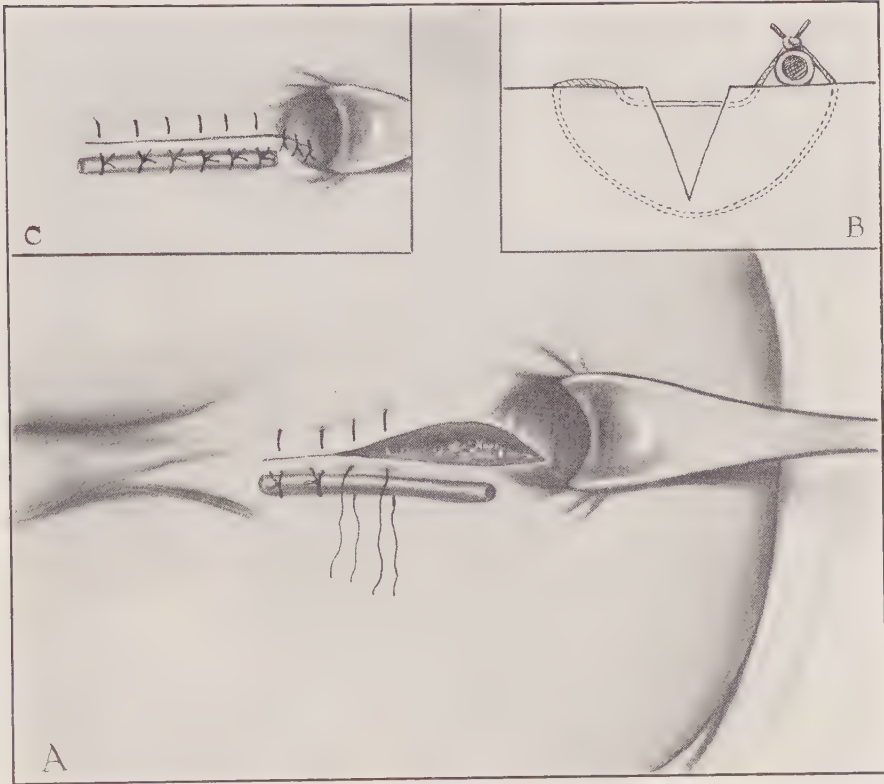


FIG. 184.—EXCISION OF FISTULA AND IMMEDIATE SUTURE.

A, wound partly closed; *B*, method of passing the sutures; *C*, the completed operation.

small rubber tube is inserted into the rectum and gauze compresses are retained over the wound by a T-binder or strips of adhesive plaster applied transversely. The external dressings are changed when soiled. The drains are left in place until the fourth postoperative day when the bowels are moved by an enema administered through the tube. At this time the packing often comes away of itself or can be loosened with slight traction. Thereafter the patient receives a regular diet, moves the bowels daily with mineral oil or other mild laxative, if necessary, and takes a hot sitz-bath of boiled water or 1:10,000 potassium permanganate solution night and morning. The permanganate solution seems

to control infection and stimulate healing. At first the wound is dressed daily after the morning sitz-bath and then at longer intervals, depending upon the progress of the case. After the packing inserted at the operation is removed the subsequent dressings are of the greatest importance to secure a firmly healed wound. Many of the failures occurring in hospital practice are directly traceable to delegation of the after care of fistula cases to inexperienced internes.

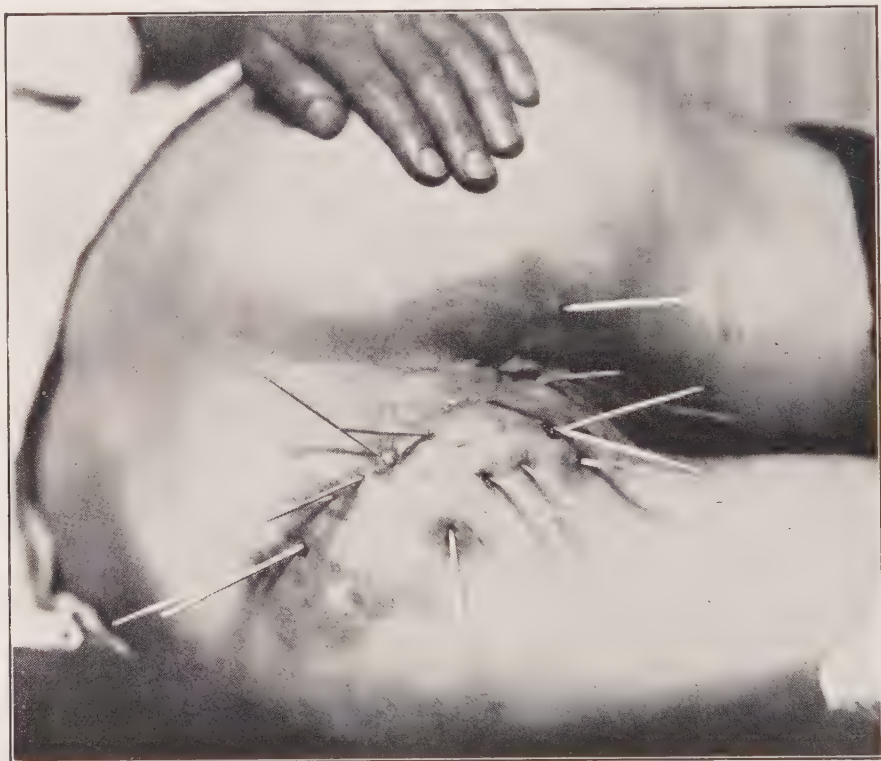


FIG. 185.—WATERING-POT FISTULA, WITH SINGLE INTERNAL OPENING.
Male, aged forty-one years.

The operation may have been correctly performed but the result marred by the later treatment. The cleansed wound should be *drained* and not *packed*. Tight packing delays healing and causes excessive scar tissue formation. Exuberant soft granulations are promoted by the application of 10 per cent iodine in glycerin which the author prefers, as a rule, to silver nitrate, which stimulates excessive scar-tissue formation. Bands of granulation tissue tend to bridge across the wound leaving a clear space beneath. If they are not recognized promptly and broken down, the foundation is laid for persistence of the fistulous tract. The chief reasons of non-healing and of recurrence of fistulæ are:

1. Inadequate operation:

Failure to find and open through the pathological internal openings in the bowel.

Failure to open all of the collateral tracts, evidenced by persistent or increased discharge from the wound.

Poor drainage—too little tissue cut from outer part of the wound.



FIG. 186.—SAME CASE FOUR MONTHS LATER.

Cured by multiple minor operations under local anesthesia. Patient ambulant during treatment.

2. Careless or inexperienced postoperative care.

Plugging instead of *draining* the wound.

Unrecognized Bridging.—Immediately upon their discovery, these new-formed connective-tissue bridges should be broken down with a probe or cut with scissors.

3. Rarely a constitutional condition, as tuberculosis, diabetes or syphilis.

ABSCESS AND FISTULA.—When an abscess complicates a fistula it is usually advisable to drain the abscess first and open the fistula later, when most of the infection is eliminated. This should be the rule if the abscess is of considerable

size and active. Otherwise uninvolved tissues are laid open to infection and a much longer period is required for healing than when the two-stage method is followed.

DIVISION OF THE SPHINCTER.—All of the laity and many physicians assume that the incision of a fistula implies division of the anal sphincters, one or both, and consequent incontinence of feces. As a matter of fact, very few properly

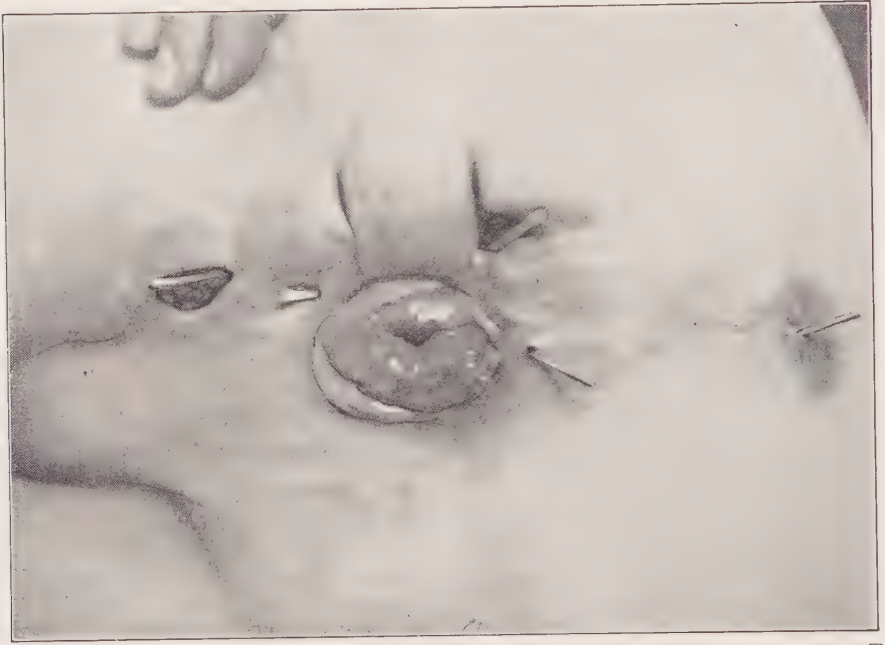


FIG. 187.—UNHEALED FISTULA WITH PROLAPSE DUE TO DIVISION OF SPHINCTER AT TWO POINTS.

Male, aged thirty-nine years.

performed operations for fistula are followed by incontinence. It is true that the internal opening of the vast majority of fistulæ is situated between the sphincter muscles, but the tract of the fistula is usually superficial to the muscles or involves the superficial fibers only of the external sphincter. The thickened tissue felt over the director passed through the fistulous tract, is not the external sphincter but largely the indurated wall of the tract, the division of which does not affect control of the bowel. However, in many cases, the tract passes deep to the external sphincter and, less often, deep to the internal sphincter. If the internal opening is in the midline posterior, its usual situation, no fear of incontinence need be entertained in cutting through one or both sphincters in the posterior commissure. Due to the partly parallel arrangement of its fibers at this point, incision here separates, rather than severs, the external sphincter muscle.

In the majority of fistulæ opening anteriorly, the tract is superficial to the external sphincter, but, if deep to it, the muscle may be divided in the midline, with impunity.

FISTULÆ WITH LATERAL OPENINGS.—When the tract runs deep to one or both sphincters the greatest care must be exercised to avoid incontinence. Cutting the sphincter muscles in this type of fistula is most often followed by incontinence. The surgeon has a choice of two methods: First, excision with immediate suture, if the tract is straight and discharging very little (a rare combination); or, second, and more generally applicable, after incision of the tract up to the sphincter, an unabsorbable seton is tied about the remainder of the tract, including the sphincter, and when the wound has largely healed, in a fortnight or so, divide the remainder of the tract, cutting the sphincter at a right angle. The scar tissue formed meanwhile by the healing wound prevents wide separation of the ends of the subsequently divided sphincter and the gap is closed by a comparatively short fibrous bridge.

The rule is imperative to divide the sphincter at a right angle regardless of the number or situation of the external openings. All of the tracts are opened into the single main channel which leads to the internal opening. The latter is cut through at once or at a second sitting. Oblique division of the sphincter results in a wide gap, closed by a narrow fibrous bridge, and an inefficient muscle.

Surgeons express divergent views on the comparative importance of the two sphincters in rectal continence. My own observations are that, after division of one or both sphincters at a single point, there is rectal continence of *formed* feces, but at times a slight amount of mucus may seep out. The escape of flatus varies considerably and there is no doubt that an efficient external sphincter is essential for its control.

It is remarkable to observe the excellent rectal control in some patients who have been operated upon several times for fistula. The anal sphincters may have been practically destroyed, but the levator ani muscles, acting upon the shortened, fibrous anal canal, give almost incredible control.

FISTULÆ WITH MULTIPLE INTERNAL OPENINGS.—Fistulæ with multiple internal openings are comparatively rare. They occur clinically in two forms: Those with tracts superficial to the external sphincter, and those with tracts passing above the sphincter. The former result from superficial infection which, in some cases, encircles the anal canal, more or less completely beneath the skin, and perforates its mucocutaneous lining at a number of points. Of course, in fistula of this form, all of the tracts and internal openings are laid open at the same operation. Reference is probably made to this type of fistula by those who advocate opening through all tracts at the same sitting. It is the only rational thing to do, as the external sphincter muscle is not involved and there is no danger of incontinence.

When, however, the tracts pass beneath the sphincter muscle, the method of operation is quite different. Simultaneous division of the sphincter at two different points inevitably results in incontinence. One tract is cut through, and after

this has healed, the incision of another fistula and the sphincter at another point may be safely performed. Thus each of the tracts is opened in succession until all of them have been treated.

VERY HIGH INTERNAL OPENING.—A fistula with a high internal opening presents a serious problem. The patient is better off with a fistula than with an incontinent rectum. The best and safest plan in these cases is partial division of the fistula and the passage of a seton. As the wound heals in toward the rectum, which is its tendency, the tissues toward the rectum are divided further and the seton tightened and finally, after healing has progressed sufficiently, the remaining narrow bridge of tissue is cut through safely.

HORSESHOE FISTULA.—This term refers to that special form of fistula which partially surrounds the rectum, crossing from one side to the other. It may be anterior, traversing the perineum, or posterior in front of the coccyx. Anterior horseshoe fistula is usually quite superficial and operation by incision is relatively simple and effective. The posterior variety is the usual form encountered and in a typical case presents an internal opening in the posterior commissure between the sphincters and one or more external openings on one or both sides. An atypical case may have no external opening and in form is virtually a blind internal fistula.

Judgment gained by experience is a valuable asset when operating upon horseshoe fistula. If the tract is deep, the best plan is to make an incision on each side of the anus from the external openings, converging to the sphincter opposite the internal opening. The median band of tissue is not divided but left to anchor the rectum until the opened tracts have partially healed. Then the remainder of the tract is opened under local anesthesia. By this plan a large gaping wound with subsequent deformity, retraction of the anus and ends of the divided sphincter muscle are avoided, and an excellent cosmetic and functional result obtained. In other cases where the tract is more superficial the entire operation can be performed safely in one stage. If no external openings are present, the internal opening is usually quite large and readily felt. The principle of operation is to convert the blind internal fistula into a complete fistula and treat it on the same lines as the latter.

BLIND INTERNAL FISTULA.—The principle of operating is to convert the blind internal into a complete fistula. The internal opening is usually quite large but may be so small that there is difficulty in following the tract. After inserting a duck-bill type of speculum into the rectum to expose the opening a curved probe or director is passed through the fistulous tract and its point, felt or seen beneath the skin, is cut down upon. The overlying tissues are divided, care being taken to cut the sphincter at a right angle. The edges of the wound are retracted and any subsidiary tracts found are opened. Undermined skin is ablated freely to prevent pocketing. The postoperative care is essentially the same as for a complete fistula.

BLIND EXTERNAL FISTULA.—Recent fistulæ of this type heal readily when they are opened freely. Chronic cases, however, frequently recur after repeated

operations. The cause of this is probably a minute opening in the bowel as remarked under Etiology. The operative treatment is governed accordingly. If the diagnostic methods fail to establish a connection with the bowel, and considerable tissue intervenes between the probe in the fistulous tract and the finger in the rectum, all the tracts should be laid open and scar tissue and skin cut away sufficient to make a shallow wound, large enough superficially. The after care is the same as for simple fistula.

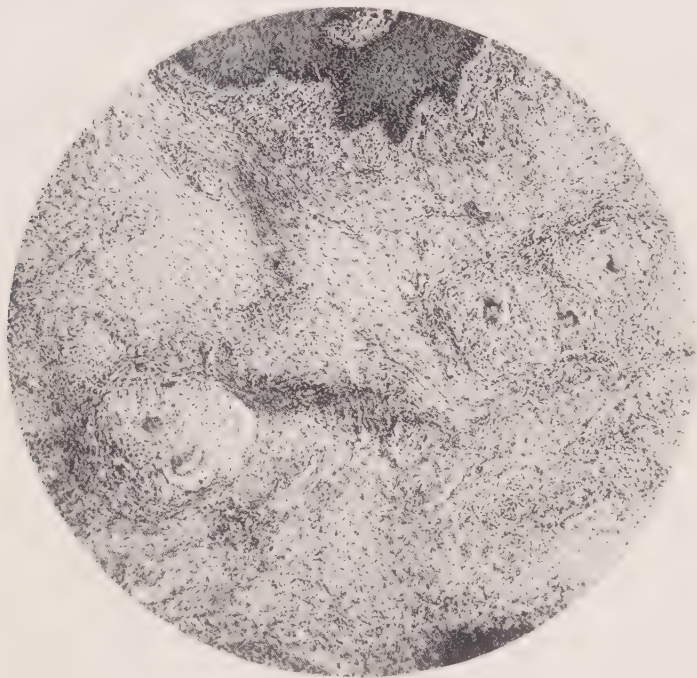


FIG. 188.—PHOTOMICROGRAPH OF SECTION OF THE TRACT OF A TUBERCULOUS FISTULA.

Note large amount of fibrous tissue and giant-cells. Male, aged fifty-nine years, who also had pulmonary tuberculosis.

On the other hand, in cases where recurrence has followed operation and only a thin, tissuelike membrane is felt to intervene between the finger in the rectum and the probe in the tract, a small pathologic opening most probably exists at this point. The procedure most likely to result in success is to push the probe through this thinned area, bring it out through the anus and divide the overlying tissue. Thus the blind external is converted into a complete fistula and its postoperative treatment is the same as for the latter.

Personal experience in these cases justifies the opinion that if this procedure were followed more often in the class of cases indicated, recurrences after operation would be less frequent. The practice formerly more in vogue, of passing a director to the highest point possible of a fistulous tract, then push-

ing it through the rectal wall and severing all overlying tissues, is mentioned only to be condemned. Poor bowel control with occasional cure of the fistula resulted, but failures were frequent, as the pathologic opening in the mucosa was not eliminated.

TUBERCULOUS FISTULA.—Many authentic cases have been reported in which dissemination of tuberculosis followed operation on a fistula. As a consequence a traditional prejudice engendered in the lay mind was frequently shared by physicians against surgical interference in these cases. This prejudice justly persists and is controlling in certain types of cases, but not in others. *Fistulæ* occurring in patients with active or latent pulmonary tuberculosis are usually tuberculous but not necessarily so. When the process in the lung is active, radical operation on a complicating fistula would be the height of folly. Local interference should be limited to the maintenance of drainage and the chief effort directed toward building up the general resistance of the patient. Local measures of great benefit are daily exposure of the parts to the rays of a quartz lamp and suberythematous doses of the x-ray at intervals of one to three weeks, depending upon the reaction. These physical agents stimulate leukocytosis and the lamp tans the skin, both of which are favorable protective measures.

There is, however, another group of *fistulæ* in which radical operation may be done. They are the *fistulæ* having the characteristics of the tuberculous variety, occurring in patients without evidences of an active primary focus elsewhere, or in arrested cases of pulmonary tuberculosis. The basis for confidence in operating on this class of patients is the pathological studies of Henri Hartmann, of Paris, on a large number of excised tracts of tuberculous *fistulæ*. He found that outside the granulation tissue lining the tract, the density of the cicatricial tissue forming its wall is increased toward the periphery. Likewise the number of tubercle bacilli and giant-cells diminish the further one observes from the lumen outward, finally disappearing altogether in the dense periphery. This is a striking example of the natural method for the protection of the organism against the invasion of the tubercle bacilli by a definite, limiting wall.

The fistula in these cases is to be regarded and treated as a localized tuberculosis. Operation is by excision or incision by a special method. Obviously excision with immediate suture is suitable only for a simple straight fistulous tract. The experience of Hartmann and other surgeons is very encouraging in carefully selected cases of this type. For the majority of cases the preferable method is slow incision of the fistulous tracts by the actual cautery at a dull red heat. This valuable suggestion of Hartmann is sound and merits the general adoption accorded it. Slow cauterization destroys the infection in the burned area and leaves an eschar, covering the wound and lining the canal, which effectually bars dissemination of infection. By the time the eschar is cast off, on about the eighth day, nature has built a barrier. The after treatment is limited to simple drainage. Sometimes 10 per cent bismuth paste is helpful. If healing is delayed, suberythematous doses of the x-ray and radiation from a quartz light

are stimulating. The author has had no dissemination of infection following operation by the method outlined on a large number of tuberculous fistulæ. On the contrary, the results have been very good in selected cases.

Chisholm reports gratifying results of operation by the cautery method on fistula in ano in tuberculous subjects under sacral anesthesia. During the years 1924-1925, he operated upon twenty-two patients, in whom pulmonary tuberculosis was active in twenty and arrested in two. Fifteen were males, seven were females. Their ages ranged from twenty-two to forty-three, average thirty-three years. Of these, twelve had multiple fistulæ and ten a single complete fistula. Healing was complete in every case in from six weeks to three months. Although several of the patients were observed over two years, there was no case of recurrence and in no instance did the operation aggravate the pulmonary tuberculosis. In some an apparent improvement of the pulmonary condition was noted after the fistula was healed.

COMPLICATED FISTULÆ

This class comprises all fistulæ which connect the anus, rectum, or pelvic colon with the genital or urinary organs, and those leading to diseased foci in the pelvic bones or vertebræ.

Originating in Bone Disease

Tuberculosis, osteosarcoma and necrosis of the pelvic bones or spinal vertebræ result in abscesses which may open in the perianal region or into the rectum proper. The site of the external opening of a fistula formed in this manner gives little guidance as regards the site of the primary disease. The opening into the bowel may be at any point in the rectum or pelvic colon, but it is usually in the ampulla of the rectum. Often, even after rupturing into the rectum, the abscess may burrow down and perforate the perianal skin.

Symptoms.—The symptoms are those of a *cold abscess*. Fever is absent or slight but there is pain in the spine or legs and a dull ache in the pelvis.

Diagnosis.—The history and examination indicate that the fistula originates in the diseased bone. An x-ray study of the patient yields positive proof of the location of the lesion and usually of its nature. In suitable cases, after injecting the fistulous tracts with a medium, opaque to the rays, as thin bismuth paste, preferably lipiodol and oil, roentgenograms will demonstrate the tracts and their connection with the primary focus.

Treatment.—The lesion in the large majority of these cases is tuberculosis of the bones. Open air and sunlight, nutritious diet, cod-liver oil, rest and suitable local support by braces, are the chief measures to increase the constitutional resistance. Operative treatment is limited to keeping the lowest point of the tract well open, thus facilitating drainage and preventing extension by burrowing.

Connected with Other Organs

Anorectal fistulæ communicating with other organs are classified as:

Urinary

Rectovesical (sigmoidovesical)
Recto-ureteral
Perineal

Genital

- (a) Rectovulval or fistulæ opening into the genital tract anterior to the hymen
- (b) Fistulæ opening above the hymen
 - Recto-uterine
 - Rectovaginal

Congenital fistulæ are considered in the chapter on congenital malformations.

Urinary fistulæ are largely confined to the male sex due to interposition of the vagina in females between the rectum and the urinary organs. On the other hand, genital fistulæ almost always occur in women.

Urinary Fistulæ

Recto-ureteral and perineal fistulæ belong in the field of urology, leaving recto-urethral and rectovesical fistulæ for our consideration.

Recto-urethral Fistula.—This condition occurs in men as a pathologic communication between the rectum and the urethra. The opening in the urethra is always in its prostatic or membranous portion, and in the rectum it is usually above the external sphincter. Urethrorectal is the term that would perhaps describe this form of fistula more accurately, as the vast majority of them originate in the urethra, and open into the rectum at a lower level. Further, the urine escapes into the rectum much more frequently than do the intestinal contents into the urethra, due less to the course of the tract than to its size.

Etiology.—The fistula may be traumatic or pathologic in origin. The chief sources of trauma are sounds and bougies making false passages in the urethra, especially while attempting to dilate a stricture; injury of the rectum during operations on the urethra, perineum or prostate, particularly in perineal prosta-tectomy.

The majority of cases are the result of a pathologic process, notably a neglected urethral stricture. Rarely it follows an abscess of the prostate, whether simple, gonorrheal or tuberculous.

Symptoms.—The pathognomonic symptom is the passage of urine into the rectum during urination; occasionally gas, and often feces through the urethra. The size of the opening, the length and direction of the fistulous tract and the degree of obstruction in the natural canals below the fistula (urethra or rectum),

determine the amount of such discharges. The rectal mucosa is usually intolerant to urine so that it is expelled immediately it is received.

Diagnosis.—The opening is within reach of the examining finger and, if large, a steel sound introduced into the urethra can be felt. An oblique, fine tract may be felt as a linear induration and, after introducing a conical speculum into the rectum, a bent probe may make contact with the sound. In doubtful cases, a little colored fluid injected into the urethra and appearing in the rectum, will decide the question. The only condition entering into the differential diagnosis is rectovesical fistula. If colored fluid is injected into the bladder through a catheter, it will appear in the rectum immediately in a case of rectovesical fistula, whereas in recto-urethral fistula it does not appear in the rectum until micturition takes place.

Prognosis.—There is very little tendency for spontaneous cure, except in a few of the cases which result from operative procedures. When due to a pathological process, operative closure of the tract usually failed until quite recently. Stimulation of the tract by silver nitrate and by cauterization, and constant catheterization have very few cures to their credit.

Treatment.—The two basic principles of successful surgical treatment are: First, the removal of all obstructions in the urethra (urethral stricture) and rectum (spasmodic anal sphincters, stricture or growths of the rectum) which prevent the free passage of urine or intestinal contents through their normal channels; second, obliteration of the fistulous tract.

Much surgical ingenuity has been used to devise a successful operative procedure. Notable among these pioneers are Sir Astley Cooper, Ziembicki and especially the author's distinguished preceptor, James P. Tuttle, who evolved a new principle and applied it successfully in eight of nine cases treated.



FIG. 189.—RECTO-URETHRAL FISTULA.

(1) Tract running downward and backward, probably originating in urethra; (2) tract running downward and forward, probably originating in rectum.

More recently, Young and Stone have obliterated the rectal side of the fistula by dissecting up a cuff of rectal mucosa to such a distance above the fistula that its rectal opening can be brought outside the anus without undue tension on the mucosa. The urethral opening is closed separately. This method is sound, both in theory and practice. The operation is performed as follows:

First, suprapubic drainage of the bladder is established, with the patient in dorsal posture. The patient is then shifted to the exaggerated lithotomy position. A racket-shaped incision, beginning in the midline of the perineum about 3 centimeters anterior to the anal margin, is carried backward to this margin, and then encircles it at the mucocutaneous juncture. Through the circular part of this incision the mucosa of the rectum is dissected free all around until a cylinder of the membrane is stripped from its attachments well above the point at which the rectal orifice of the fistula opens, the fistulous tract, of course, being divided transversely in this process. This ascending dissection of the bowel is carried upward until sufficient mucous membrane is loosened to permit the pulling of the segment containing the fistulous orifice well out of the anus, the orifice and a small margin of normal mucosa above it, and all that below it, lying outside the skin level and later being excised. Next, the structures of the perineal body are divided through the straight incision in the midline—the handle of the racket—so as to expose thoroughly the urethral orifice of the fistula.

The edges of the urethral fistulous opening are freshened and brought together with catgut sutures over a sound previously passed through the urethra. These sutures do not penetrate the surface of the urethral mucous membrane. The levatores ani, fascia, and smaller muscles are then brought together by interrupted catgut sutures across the midline of the perineum in several layers, reconstructing the perineal body much as is done in gynecologic operations for relaxed vaginal outlet. Finally, the sphincter ani is restored by uniting its ends with a mattress-suture of catgut, and the midline incision is closed with interrupted sutures. The last stage in the operation consists in the excision of the protruding cuff of rectal mucosa in which the fistulous opening lies, and the union of the lower end of the rectal tube to the anal skin margin by interrupted silk sutures after four submucous-subcutaneous sutures of catgut have been placed at quadrant points to help to anchor the bowel in place.

Rectovesical and Enterovesical Fistulæ.—These are communications between the bladder and the rectum or higher portions of the intestinal tract due to injury or disease. Fortunately this is a rare though a very serious condition. Statistics show that the intestinal opening is in the rectum in approximately 40 per cent of cases, in the sigmoid in 30 per cent, in the small intestine in 20 per cent, in the small and large bowel in 7 per cent and in the appendix in 3 per cent.

Etiology.—Traumatism by puncturing injuries or by gunshot wounds, foreign bodies or stone in the bladder or rectum may be causal. The vast majority, however, are due to pathologic processes. Prostatic disease, either suppurative or tuberculous, may open into the bladder and then into the rectum, or vice versa,



FIG. 190.—SIGMOIDOVESICAL FISTULA DUE TO DIVERTICULITIS.
Male, aged fifty-two. Sodium iodid solution in bladder, barium in sigmoid.

forming a rectovesical fistula. In women, extensive pelvic inflammation and abscess may result in a communication between the bladder and the sigmoid flexure or small intestine. Malignant disease of the rectum or sigmoid may perforate the bladder, or a carcinoma of the bladder may invade and open into the bowel. This result does not occur as frequently as one might expect in the large incidence of carcinoma in these organs. Tissue necrosis resulting from the implantation of excessive doses of radium emanation seeds (radon) in a neoplasm situated opposite the bladder, may establish a communication between the two organs.

Diverticulitis of the sigmoid, with adhesions to and suppurative perforation into the bladder, is clearly the most common cause of vesicosigmoidal fistula. Comparatively recent knowledge of the pathology of diverticulitis shows that sigmoidovesical fistula was more often ascribed by earlier writers to tuberculosis or malignant disease than is the case. An inflamed vermiform appendix may become adherent to and perforate the bladder in a way analogous to diverticulitis.

Pathology.—The fistula may be direct or indirect. When perforation occurs where the intestinal wall and bladder are directly matted together, the fistula is *direct*, short, and the openings are opposite each other. Thus there may be a direct communication between the rectum and the bladder in the trigone region; or, higher up in the vesical fundus, with the sigmoid or small intestine.

When the fistula is the result of an abscess rupturing into both organs, it is *indirect*, more or less elongated, of irregular shape and the openings usually not opposite each other.

Symptoms.—The cardinal symptoms are pneumaturia, fecaluria and anal micturition. The predominance of one or other of these symptoms depends upon the size of the openings, the situation, the direction and character of the canal, and the nature of the pathologic process causing it. In fact, the underlying, primary disease, as chronic diverticulitis or cancer, may be under treatment at the time the fistula develops and so give a clue to its nature and location. Feces pass from the urethra more frequently than urine does from the rectum. Later, the symptoms of proctitis develop, a result of irritation by the urine; and cystitis from feces in the bladder, to be followed, in many cases, by an ascending infection of the kidneys, which renders the condition so serious.

Diagnosis.—Fecaluria and anal micturition establish the diagnosis. Often cystoscopy may detect the abnormal opening in the bladder, or the observer may see a staining fluid, injected into the rectum, flow into the bladder. Staining fluid injected through a catheter into the bladder, may appear in the rectum. On the rectal side, the finger may feel an opening within 4 inches of the anus and proctoscopy may reveal one at a higher level. A competent x-ray study of the bowel and bladder may give valuable information.

Prognosis.—A few cases, mostly of the traumatic variety, have resulted in spontaneous cure. In general the prognosis is grave unless operation can effect a cure. In the direct cases, the danger is cystitis and an ascending infection of the

kidneys. In the indirect variety, accumulation of intestinal contents and urine in the intervening abscess cavity, may result in urinary infiltration or suppurative burrowing which may rupture into the peritoneal cavity, causing fatal peritonitis. Infiltration and suppuration in the perirectal tissues may finally perforate the perianal skin and chronic septic absorption sap the patient's vitality.

Treatment.—Administration of urinary antiseptics, as urotropin with acid sodium phosphate, and lavage of the bladder with antiseptic solutions, aid in controlling the cystitis and preventing infection of the kidney. Irrigations of the rectum allay irritation in cases where the mucosa does not tolerate the urine. Irrigations should be carried out regularly and with the greatest gentleness by experienced persons. A constipating diet is beneficial. Fluid stools readily pass through the fistulous tract. When a fistula results from accident, injury or operation, permanent catheterization of the bladder and keeping the bowel constipated may possibly effect a cure. When the fistulæ are caused by pathological processes, the above measures may be considered palliative only and, while contributing to the comfort of the patient, no expectation of their curative value is entertained.

The question of surgical intervention will depend upon the age and general condition of the patient, the location of the fistula and the causative factors. Obviously it would be unwise to attempt any major operation on a debilitated old man.

DIVERSION OF THE FECAL CURRENT.—If the communication is between the rectum or lower sigmoid, a temporary colostomy is indicated and is a most salutary procedure. Colostomy can be performed readily and without risk under local anesthesia. It accomplishes a diversion of the fecal current, so that infection from this source is excluded; improves the general condition of the patient to such a degree that a more radical operation may be performed later, and finally places the parts in the most favorable condition for spontaneous closure of the fistula. Spontaneous closure occurred in one of the author's patients where the communication was between the sigmoid and bladder. The case history is given in the chapter on Diverticulitis.

After colostomy, closure of the fistula may occur in cases due to injury or simple infection, as diverticulitis. When tuberculosis or cancer is the cause, of course, the tract would not be expected to heal. If x-ray examination shows the sigmoid to be short and fixed, it is preferable to make the artificial opening in the transverse colon, especially if a radical operation is contemplated later.

Due to its inaccessibility, operative closure of a rectovesical fistula is a difficult procedure. Several methods have been suggested, none of which is applicable in every case. If the fistula can be reached from below, the principle of operation is transverse division of the perineum, dissection of the rectum from the prostate and bladder till the fistula is reached; transverse division of the fistula, freshening its margins on each side; suture of the openings in the bladder and the rectum separately, and packing the intervening

space with gauze. Preliminary colostomy is essential to the success of the operation.

If the intestinal opening is in the sigmoid or at a higher intestinal level, approach is obtained through an abdominal incision. The majority of these cases is in the sigmoid colon. Some of the sigmoid cases have a comparatively small connection with the bladder and may be suitable for operation; while in others the bowel is intimately fused with the bladder over such a wide area that operation could only result in disaster. For the latter group a colostomy is all that should be attempted. If, after opening the abdomen, the condition is considered suitable for radical operation, the principles to be followed are separation of the bowel from the bladder, and, after dissecting the fistula from the bladder wall, closure of the opening with two rows of Lembert sutures. The opening in the sigmoid may be inverted by a double row of sutures, but if the situation of the stoma will permit, it is far preferable to bring this segment of bowel out through the abdominal incision, where with the peritoneum sutured around it, it is retained until the fistula closes spontaneously or is closed by suture. The site of operation is flushed with ether, sponged dry quickly, and a large cigarette-drain inserted.

Genital Fistulæ

Rectovaginal Fistula.—This type of fistula rather frequently follows injuries at parturition. Prolonged pressure of the head during labor may produce tissue necrosis, the fistula appearing a few days later when the slough separates. Occasionally it is due to pressure of a pessary. Venereal infection may result in abscess in the rectovaginal septum, the rupture of which is followed by a fistula. A perirectal abscess may also rupture into the rectum and then perforate the vaginal wall. Infection and abscess of Bartholin's glands may extend backward, opening at the margin of, or into the anus. Rectovaginal fistula is a frequent complication of advanced carcinoma or tuberculosis of the rectum, and of stricture of the rectum. In the latter the communication is more often below than above the constriction.

The opening is usually direct and palpable per anum, in the midline and within 2 inches of the skin surface. However, the canal may be narrow and tortuous, with openings on different levels, and be difficult to detect. In these cases, there is a history that, at the onset, some pus and blood was discharged from the rectum. This soon ceased, however, and the symptoms may be slight.

If the fistula is of appreciable size there is usually a history of the passage of gas or feces per vaginam, the perforation can be felt and a probe passed through it. Hydrogen peroxid injected into the rectum may be seen to bubble through into the vagina as the anterior vaginal wall is retracted with a speculum.

Treatment.—In cases of rectovaginal fistula complicating tuberculosis, cancer or stricture of the rectum, therapeutic measures are directed toward the primary condition. Colostomy in the sigmoid colon is usually indicated, easily and safely performed, and confers marked benefit.

For a narrow fistula, silver nitrate fused on the end of a probe and carried through the tract may be tried, but its success is problematical. Larger openings, near the vaginal outlet which is their most common site, may be operated upon successfully. The tract is usually lined with epithelium, so little or no discharge is present. The patient should be prepared for a week by antiseptic douches and rectal irrigations to eliminate infection, as far as possible. Under general anesthesia and in the lithotomy position, after making the usual local preparation, the perineum is divided medially up to the fistula. A probe is



FIG. 191.—CLOSURE OF RECTOVAGINAL FISTULA, SHOWING MUCOUS FLAP BROUGHT OUTSIDE OF RECTUM AND SUTURED TO THE SKIN.

passed through the tract and the fistula dissected free. The mucosa on the anterior wall of the rectum is then dissected up until it can be drawn down to the anal verge without tension, thus completely obliterating the rectal opening. Next, the perineum is restored by buried chromicized catgut sutures, care being taken to unite accurately the severed ends of the external sphincter muscle. The vaginal incision is closed with a continuous suture, and the flap of rectal mucosa, previously loosened, is drawn through the anus and anchored to the skin. A small tube is inserted into the rectum and the parts are supported by gauze pads retained by adhesive plaster applied transversely. The bowels are confined for a week and then moved by injecting warm olive oil through the tube. The patient is kept in bed another week.

The features of this technic are practically a combination of a modified

Whitehead operation with a perineorrhaphy. All of the five cases of rectovesical fistula in which the author used this technic were cured.

Another method is to close the fistula from the rectal side. This is applicable when the rectal opening is low enough to be invaginated through the anus. After raising the vaginal flap, the rectal opening, invaginated through the anus, is closed with linen sutures and reinforced on the vaginal side with the chromicized catgut sutures. The vaginal opening is trimmed and sutured and the operation completed by repair of the pelvic floor.

Recto-uterine fistula is an unusual occurrence and belongs to the domain of gynecology.

Rectovulval Fistula.—In this group the genital opening is anterior to the hymen. It ordinarily results from an infection of Bartholin's gland, the pus burrowing backward, beneath the superficial fascia of the perineum, and opening into the anal canal, or at its margin, in the anterior quadrant of the same side as the labial abscess.

In a recent acute case in a woman, aged nineteen, the usual tract from the labia to the anal canal was present, but the infection had also extended from this to the postrectal space which was occupied by a large abscess. No gonococci were found. The condition required liberal drainage but no impairment of the sphincter function resulted.

Rectovulval fistula may also follow a perineorrhaphy in which primary healing was not obtained, or result from injuries during parturition.

Treatment.—In view of their superficial situation and the considerable infection usually present, the safest method of operation is to pass a grooved director through the tract and incise the overlying tissues. The wound is then carbolyzed and subsequently treated as any other open fistulous tract.

If the tract runs deep to the vagina and the external anal sphincter; excision of the fistula with immediate suture is the surgical indication. Sitz-baths, and other local measures to reduce the infection, should be employed several days before the operation by excision.

Complications in Fistula Operations

Hemorrhage.—Bleeding is the only important complication while operating for fistula. As a rule, only small vessels are cut and the slight oozing is readily controlled by pressure with gauze. In cases where the fistula extends upward beneath the rectal mucosa, requiring its division, bleeding may be severe and troublesome. The chief blood-vessels lie in the mucosa and submucosa; hence, if the margins of the rectal wound are grasped in long forceps, hemorrhage can usually be checked. Firm packing, searing the margins of the wound with the actual cautery, or ligation of a few vessels will usually be efficient. Should an artery be cut high in the rectum, it should be caught in a long forceps and tied. If its high situation prevents the application of a ligature, the forceps left *in situ* for twenty-four to thirty-six hours, will effec-

tively control the hemorrhage. Good exposure of the wound is essential in locating the bleeding points.

Retention of Urine.—Because of the intimate association of the nerves controlling the anal and vesical sphincters, reflex retention of urine is a frequent complication after operation for fistula. This usually passes off in a day or two. Catheterization of the bladder and its possible attendant infection are to be avoided, if possible. A delay of twelve to eighteen hours is advisable before using the catheter. Measures usually successful to induce voiding are:

Allow the patient to stand by the bed or sit on a commode; removal from the wound of too tight packing; the administration of dram doses of sweet spirits of niter in a half glass of water, or still better:

R	Methenam.	℥ ii
	Sod. benz.	℥ ii
	Tr. hyosc.	℥ iv
	Aq. dest. q.s. ad	℥ ii
	Sig. Dram i in water, q. 3 h., till relieved.	

Should these measures fail, a catheter should be passed into the bladder under strict aseptic conditions.

Prolapse of Hemorrhoids and Mucosa.—When operating upon a fistula, the question of coincident removal of associated internal hemorrhoids presents itself. The wisdom of their removal depends upon the amount of suppuration present. If there is considerable suppuration, operation on the hemorrhoids should be deferred lest the wounds become infected; but when there is only a slight amount of discharge, the piles may be removed by the clamp and cautery.

Sometimes after operation for fistula, due to relaxation of the parts, hemorrhoids not previously present will develop, or the rectal mucosa may prolapse. Under local astringent applications, these conditions tend to improve and cause no further annoyance after the wound of the fistula has healed. If they do not subside, then the hemorrhoids may be treated by the injection method. A more certain and satisfactory procedure, however, is to remove the offending piles or mucosa by the clamp and cautery.

Incontinence of Feces.—This late complication of operation for fistula is the most serious of all. Fear of incontinence deters many sufferers from fistula from undergoing an operation. As a matter of fact, permanent incontinence should never follow an operation for fistula properly performed, and in accordance with the technic already described. A mild degree of incontinence frequently occurs while the wound is healing, but perfect control is usually regained when healing is complete. Nevertheless, unfortunate cases of incontinence are occasionally encountered after extensive and imperfect operations for fistula. In these, plastic restoration of the parts offers the only hope of relief. Should there be marked incontinence after the wound is completely healed, time will not overcome it. A plastic operation will give the best result,

if done at once before the divided sphincter muscles have undergone further atrophy and retraction. If there is any likelihood of incontinence resulting from operation on a fistula, the possibility of its occurrence should in all fairness, be explained in advance to the patient.

REFERENCES

- CHISHOLM, A. J. *Tr. Am. Proctol. Soc.*, 1927.
TUTTLE, J. P. *Diseases of the Anus, Rectum and Pelvic Colon*, New York, D. Appleton & Co., 2d Ed., 1906.
YOUNG, H. H., and STONE, H. B. "Operative Treatment of Urethrorectal Fistula," *J. Urol.*, June 1, 1917, No. 3, p. 289.

CHAPTER XII

CRYPTITIS AND PAPILLITIS

CRYPTITIS

Between adjacent columns of Morgagni are small semilunar valves, each forming a minute pocket opening upward. These are termed the crypts of Morgagni. Ordinarily they are quite small and scarcely discernible. In some cases, however, the valves and pockets are well developed and may be catch basins for hard particles of feces or small foreign bodies, and some authors consider the rupture of one of these valves during the passage of a large fecal mass a common cause of fissure. Substances retained in a crypt may initiate an inflammation and ulceration of its lining membrane, known as cryptitis. Infection of the tissues beneath the crypt may result in abscess formation and a submucous fistula. Beach and Terrell have emphasized the importance of these fistulæ in the etiology of pruritus ani.

Symptoms.—Pain, dull and aching, or lancinating in character, may be localized in the anal canal. At other times the pain is reflex and is referred to other organs, as the uterus, dysmenorrhea; bladder, dysuria; to the testicles or the sacral region. Due to the local irritation, spasm of the sphincter and consequent constipation are usually associated, the patient deferring bowel action because of the pain induced.

Diagnosis.—Recognition of the true condition is frequently missed because a proper examination is not made. Digital palpation per anum frequently detects an exquisitely tender spot, especially when the infection is acute, but may be negative after a submucous sinus has formed. When cryptitis is suspected, a systematic examination of the crypts should be made. After introducing a fenestrated speculum or rectal retractor, a reflected light illuminates the field and each crypt in turn is gently probed by a probe bent in the form of a shepherd's crook. Normal crypts are comparatively insensitive but when diseased severe pain is elicited. If a sinus has developed, the point of the probe will follow this, ending sometimes in an external skin tab. In the author's experience, cryptitis is a rather rare condition and submucous tracts have not been present as frequently as claimed. It must be remembered that unless the greatest gentleness is exercised in the examination, the probe can be insinuated in any desired direction beneath the normal mucosa, thus conveying the false impression of a fistulous tract.

Treatment.—Once the diagnosis is made the treatment is simple. For simple inflammation of a crypt, pure ichthyol on a bent probe applied daily through

a fenestrated speculum will usually afford prompt relief. For fistula or abscess, the field, including the external sphincter is infiltrated with 0.5 per cent novocain solution. A bent probe is introduced and the tissues just deep to the probe

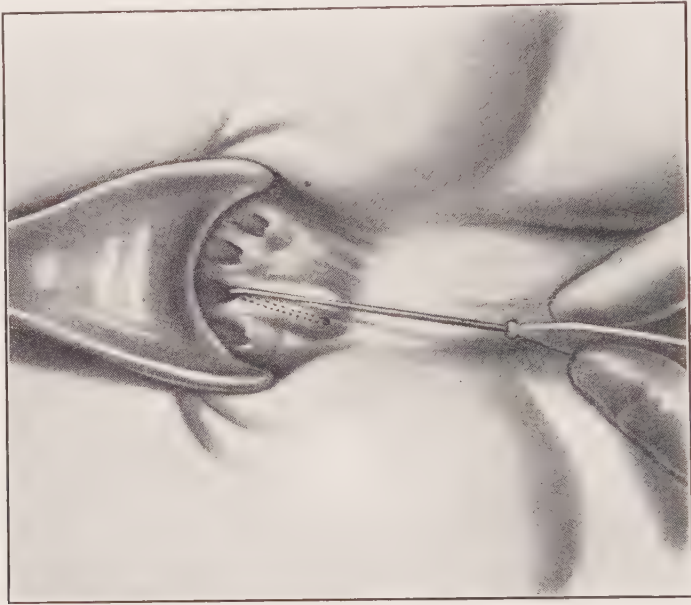


FIG. 192.—CRYPTITIS.

Anal crypts exposed by speculum. Diagnostic examination by bent probe.

ablated by a single cut of scissors curved on the flat. The wound is dressed regularly until healed. Liquid petrolatum is ordered to secure easy bowel action.

PAPILLITIS

On the anal valves or at the bases of adjacent columns of Morgagni, small teatlike growths may develop. They are usually absent but when present may cause annoying symptoms. They vary from two to five in number. According to Stroud a papilla is composed of a scant framework of connective tissue, medullated and non-medullated nerve-fibers with ganglion-cells, and a covering of stratified epithelium. Margarey confirmed the predominance of nerves in their structure. Clinically they are seen as soft limpid structures 0.5 to 1 centimeter in length or with a knoblike tip, hard and fibrous. They are frequently associated with internal hemorrhoids.

Symptoms.—A tickling sensation in the anal canal, sometimes amounting to pain, is the most usual symptom. On this account, these patients are frequently treated for worms. Margarey found hypertrophied anal papillæ in thirteen of fifty-three cases of pruritus treated at St. Mark's Hospital, London. When in the form of enlarged fibrous nodules, the patient may have a feeling of in-

complete evacuation at stool, and the papillæ, protruding during defecation, may be mistaken for prolapsing internal hemorrhoids. Sharp pain during defecation, a dull ache in the lumbar region and spasm of the sphincter are noted occasionally.

Diagnosis.—With the sphincter relaxed, the papillæ can be seen when the patient strains down; felt by internal palpation when hard and fibrous, but are best recognized through an anoscope which reveals clearly their exact situation and character.

Treatment.—Surgical removal under local infiltration is accomplished most neatly by clamping the base and ablation with the cautery. Application of a ligature at the base is equally effective.

REFERENCES

- MARGAREY, A. C. *Brit. M. J.*, Lond., Sept. 28, 1911, 2:71.
STROUD, B. B. *Ann. Surg.*, Phila., 1896, 24: 1.

CHAPTER XIII

PROCTITIS AND COLOPROCTITIS

Inflammations of the mucous membrane are among the most common pathological conditions of the rectum and colon. Prominent factors favoring inflammation are the structure of the mucosa with its myriads of Lieberkühn follicles, and the nature of the intestinal contents. The mucosa absorbs a large proportion of the fluids in which are many bacteria, leaving a hardened fecal residue which by friction and pressure may produce lesions of the lining membrane. Infection of the latter results in proctitis.

The similarity in structure and continuity of the mucosa of the colon, sigmoid and rectum, and the frequent involvement of all of these segments in the same inflammatory process, make it impossible to consider one portion apart from the others. In certain instances the disease is confined to the rectum, but in the majority of cases it extends throughout the sigmoid and upward into the colon, even to the cecum. Seldom does colitis or sigmoiditis exist without involving the rectum.

Direct inspection of the rectum and sigmoid flexure through modern electrically illuminated proctosigmoidoscopes has rendered definite and clear pathology in the living which before was obscure and largely conjecture.

Classification.—Inflammation of the lower bowel may be *acute* or *chronic*, *simple* or *specific*.

The simple catarrhal type is acute, or when chronic is classified as *atrophic* and *hypertrophic coloproctitis*. The chronic forms of the affection frequently are sequelæ of the acute catarrh.

The types of *specific proctitis* named in the order of their frequency of occurrence are: Dysenteric, gonorrheal, syphilitic, tuberculous, erysipelalous and diphtheritic.

ACUTE CATARRHAL PROCTITIS

Etiology.—Individual predisposition is undoubtedly an important factor in causation. Of several persons subject to the same conditions, only certain ones are affected. The latter are either naturally susceptible or their resistance was temporarily lowered at the time of exposure, so that the occurrence of infection was invited.

Infection is the chief cause. No definite organism is responsible, but when the general resistance is lowered or the mucosa is injured, the ordinary intestinal bacteria become the active agent.

Trauma.—Although chronic constipation seldom causes acute proctitis, accumulation of hard scybala may irritate or wound the mucosa. This is forcibly illustrated in fecal impaction.

Other causes of trauma are sodomy, foreign bodies either swallowed or introduced through the anus, the syringe tip in giving enemas, clumsy instrumentation and overzealous manipulation in performing prostatic massage. Irritating constituents of enemas may also set up an acute coloproctitis.

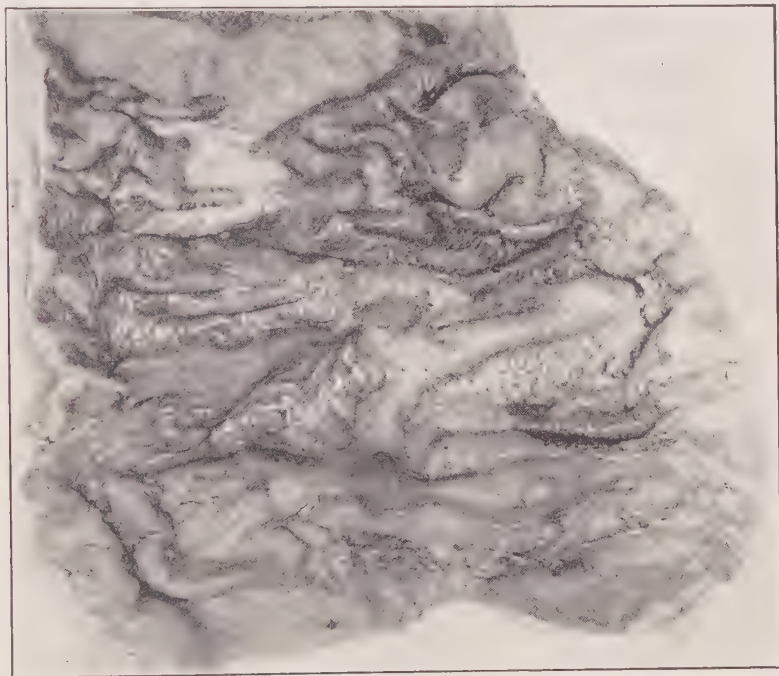


FIG. 193.—DIPHTHERITIC COLITIS.
(City Hospital Museum, New York.)

Diet and Drugs.—Improper diet, or the ingestion of spoiled fish or shellfish, frequently results in ptomaine poisoning and acute inflammation. Idiosyncrasy to certain articles of diet, such as strawberries, is another cause. Among the *drugs* are the irritating cathartics, as aloes, rhubarb, gamboge and especially the various compounds of mercury.

Intestinal parasites, the chief offender being the oxyuris, usually in children.

In *prolapse of the rectum*, constriction by the sphincters interferes with the circulation; protrusion and reduction irritate, as does friction by the clothing and desiccation by exposure of the protruded bowel to the air.

In *intussusception* of the sigmoid into the rectum, inflammation results from a circumscribed interference with the circulation and from the irritation due to the passage of fecal masses through a narrowed lumen.

Proctitis is frequently associated with other rectocolonic diseases, as hemorrhoids, ulcer, stricture and tumors, especially multiple polyposis.

A rather frequent exciting cause is chilling of the body by sitting on cold or wet seats, particularly after exercise. Proctitis may also be secondary to pathology of adjacent organs, as tumors or displacements of the uterus, inflammation of the uterine appendages, prostate or seminal vesicles, and vesical calculus.

Pathology.—The pathologic changes consist in a hyperemia and exudation of serum and leukocytes into the mucosa, which cause it to become edematous. Glandular secretion, temporarily checked, is later increased. In severe cases, desquamation of the epithelium produces superficial erosions, the infection of which results in ulcers. The inflammatory process is usually limited to the mucosa and submucosa, but in some cases may penetrate to the muscular coat and give rise to a proctitis, abscess and fistula.

The character of the rectal discharge varies. During the first twenty-four hours it is thin, fluid, fecal material; later it is blood-tinged and contains mucus; and if ulceration occurs, the discharge is mucopurulent or sanguinopurulent.

Symptoms.—The onset of acute catarrh of the large intestine is usually sudden and frequently may be traced to a definite exciting cause. Usually the first sensations are localized in the bowel, but sometimes the patient experiences prodromal symptoms—a slight chill and aching pains in the body.

The most prominent symptoms are pain and diarrhea, the frequent urgent stools being abnormal in character. The symptoms vary somewhat with the portion of bowel chiefly involved.

Acute Rectitis.—There is a sense of weight, heat and fullness in the rectum. The pain radiates to the back, sacrum, thighs and pelvic organs. In consequence of the intimate nervous connection, there results reflexly a frequent desire to micturate. From the onset tenesmus is marked. The inflamed swollen mucosa imparts the feeling of a foreign body which the patient strains to expel in his frequent and urgent calls to the toilet. The excrement is of small amount, consisting mainly of mucus, pus and blood, with comparatively little feces. In children especially the tenesmus frequently causes a prolapse of the rectal mucosa (ectropion recti).

Acute Sigmoiditis.—When the rectum is only slightly affected and the sigmoid is chiefly involved, tenesmus is less pronounced. There is a feeling of discomfort, pain in the back, and usually a paroxysm of colicky pain in the lower abdomen which accompanies each bowel action. The latter may number from five to ten in twenty-four hours and afford considerable relief. The thin stools contain an admixture of mucus, blood and pus in varying proportions.

Acute Colitis.—Although an isolated catarrh of the rectum and sigmoid is of comparatively frequent occurrence, it is exceptional for an acute colitis not to involve the terminal bowel segments. The subjective symptoms are practically the same as those of acute sigmoiditis.

Diagnosis.—In acute proctosigmoiditis, the parts are tender. Introduction of the finger is very painful. In the early stages the parts feel dry, hot and swollen; after secretion has begun, moist and slimy. The rectal walls seem close together and the lumen narrowed.

Pressure over the left iliac fossa elicits tenderness, and when the sigmoid is acutely inflamed pressure initiates the desire to defecate. This is a clinical point of value in showing the extent of the inflammation.

In colitis, abdominal palpation elicits tenderness over the course of the colon.

As the rectum and lower sigmoid can be readily inspected through a speculum, sigmoidoscopy for diagnosis should be done in all cases where the symptoms indicate a severe type of inflammation. At first the mucosa appears red and edematous and its surfaces in close apposition; later an excess of mucus covers the congested surface and superficial erosions may be observed, especially at the margins of Houston's valves. In this event the mucus is blood-tinged and in severe cases, where the solitary and agminated follicles become infected, small superficial, rarely deep, ulcers occur, with purulent discharge. Mild constitutional symptoms may be present, as general malaise with slight elevation of temperature and a quickened pulse; headache, furred tongue and anorexia.

Treatment.—Mild cases of inflammation usually subside in a few days under rest in bed, dietetic and other proper treatment. Rest, by diminishing the congestion, relieves the symptoms and adds to the comfort of the patient. The diet should be chiefly fluids, as barley or rice water, lamb and chicken broth, gelatin jellies and thin gruels. They should be taken hot, as cold preparations stimulate peristalsis. Alkaline waters for drinking agree best. Milk, in general, is not advised because of its tendency to produce hard scybala which irritate the inflamed mucosa. It is important to insure, by digital palpation, that the rectum does not contain impacted feces or a foreign body. As a rule, a large dose of castor oil should be given at the beginning of treatment to rid the bowel of any irritating, fermenting or infectious material.

When the condition does not subside promptly under this treatment, infection is more severe and local measures should be applied. Rectal irrigations are best carried out by means of a return flow irrigating tube of the Mallory or Jelks type, which can be sterilized readily. Hot solutions are soothing to most patients, but others find cold irrigations more grateful. The preferable solutions are bland and non-irritating, as normal saline, bicarbonate of soda ($\frac{1}{2}$ per cent), boric acid (2 per cent), or, if there is much bleeding, 5 per cent aqueous fluidextract of krameria. Several quarts should be used, the patient lying on his side. Thus the height to which the fluid ascends in the colon can be regulated and it is adjusted to the segment involved. Sometimes the anus is so tender and spasmodic that the sphincters must be dilated under a local anesthetic before the irrigator can be borne, unless hot sitz-baths overcome the spasm. If proctoscopy is desirable, it may be done shortly after the irrigation. After the solution has been siphoned off, a few ounces of starch water with laudanum, 10 to 15 minims, or bismuth in warm oil, may be instilled to allay the tenesmus. If ulceration and

suppuration succeed the acute inflammatory stage, daily irrigation with anti-septic solutions should be continued. Inspection at this time through the proctoscope will usually show areas of ulceration or congestion in the rectum and sigmoid. After wiping away the secretion, 10 per cent silver nitrate solution may be applied directly to the affected areas, followed by normal saline to neutralize any excess. When the lesions are distributed diffusely, the entire surface may

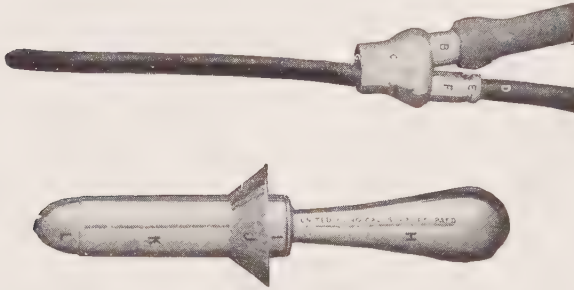


FIG. 194.—MALLORY COLONIGATOR.

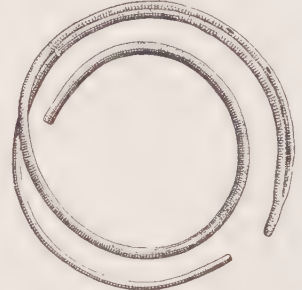


FIG. 195.—JELKS' RECURRENT RECTAL TUBE, SOFT RUBBER.
(Dutro and Hewitt, Memphis, Tenn.)

be painted with 2 per cent silver nitrate, 10 per cent argyrol or 15 per cent ichthyol in glycerin; or powders, such as equal parts of calomel and bismuth, or aristol may be applied directly to isolated ulcers or insufflated over the entire surface if ulceration is general. Medicines by mouth are not usually effective. Salol, 5 grains, and bismuth subcarbonate in doses of 30 grains four times daily tend to lessen intestinal fermentation. The author has found the following prescription very effective in relief of the griping and in checking the diarrhea in the early stage:

℞ Tr. bellad.
Tr. verat. vir. āā ℥ xv
Tr. opii camph. ʒ iv
Mis. cret. q.s.ad. ʒ ii

Sig. Teaspoonful every half hour until relieved, then only after
a bowel movement, as necessary.

CHRONIC PROCTOCOLITIS

Chronic catarrhal inflammations of the rectum and colon are doubtless of more common occurrence than is generally recognized. Two types of the disease are distinguished, the *hypertrophic* and the *atrophic*.

The essential pathology is hypertrophy of the mucosa and submucosa with an increase of all their elements; deepened Lieberkühn's glands, increased number of goblet-, mucus-producing cells, and increased stroma. These changes may extend throughout the rectum and colon.

In the *atrophic* variety, the pathologic changes are usually limited to the rectum and sigmoid. The mucosa is thinned; its follicles atrophied, goblet-cells diminished, epithelial cells exfoliated and stroma shrunken. The connective tissue of the submucosa is dense and slightly thickened.

Etiology.—The hypertrophied form frequently succeeds the acute type, or it may develop from the same causes as the acute.

Extra-intestinal causes, acting chiefly in a mechanical way, are the displaced uterus, tumors, movable kidney, bands and adhesions and chronic appendicitis. Any long-continued irritation, within or outside the bowel, reduces the local resistance and favors bacterial invasion. Coexisting diseases, as syphilis, tuberculosis, diabetes or cardiovascular, may so weaken the general resistance that the acute attack becomes chronic.

In the majority of the cases of the atrophic type, there is a history of inveterate constipation and the use of irritant cathartics and enemas.

Hypertrophic Coloproctitis.—

Symptoms of hypertrophic coloproctitis occur most frequently in plethoric individuals who are fat and flabby. If the acute attack merges into the hypertrophic form, the early symptoms are the same. Later there is vague abdominal unrest, flatu-

lence, diarrhea alternating with constipation, and at times copious passages of thick, glairy mucus. A feeling of unfinished stool frequently succeeds bowel action. The abundant secretion from the mucosa may escape through the relaxed sphincters, causing perianal erythema, dermatitis and itching, and hypertrophy of the radial folds, between which the skin may be fissured.

On digital examination the walls are closer together than normal and the mucosa feels soft and doughy. Through the proctoscope the spongy mucosa is seen thrown into concentric folds and bulging into the end of the tube. The membrane appears edematous, pale red, and is covered with mucopus, the removal of which is not usually followed by bleeding.

Bleeding and ulceration are not characteristic of hypertrophic catarrh, but may occur in the rarer *follicular* type in which the follicles are implicated usually in the course of, or as the result of, chronic coloproctitis. The shotlike follicles appear red and swollen. When ulceration supervenes, small, round, flat ulcers, usually discreet, result. They are distributed in groups, most frequently in the rectum and sigmoid, although in two of Holt's twenty cases, they were confined to the terminal ileum.

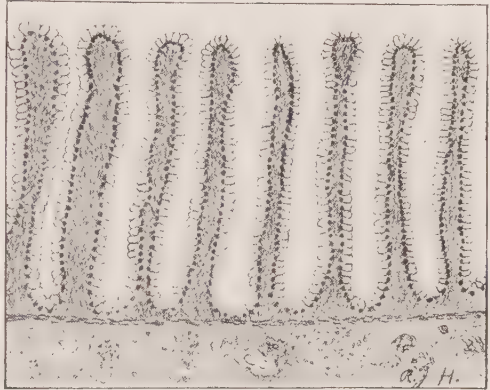


FIG. 196.—HYPERTROPHIC CATARRHAL PROCTITIS.

Specimen showing increase in depth of tubules and intertubular substance.

Treatment.—From the nature of the condition, treatment must be prolonged and tedious. Treatment is directed toward removal of the cause, followed by measures to check the inflammatory process, restore integrity of the tissues and increase the resistance of the patient. Local measures alone may not suffice. In cases where a mechanical cause exists, such as pressure from an extra-intestinal tumor, a hypertrophied or displaced organ, these conditions may have to be corrected before cure can be effected.

DIET.—In uncomplicated cases the diet should be chiefly nitrogenous—meats, fowl, fish and eggs. Strained soups of lamb, chicken or beef are permissible. Sugars and starches are limited. Bread should be stale or toasted. Boiled rice and macaroni are substituted as a vegetable for potatoes which, because of their rapid fermentation, are injurious in catarrhal diseases of the intestine. Green vegetables, as spinach, beet tops, lettuce and celery are advisable. Sweet milk is usually to be avoided, but fermented milks, Bulgarian and *Acidophilus*, are to be recommended, if they agree. Cream, butter and olive oil in salads are ordered, when it is desirable to increase the amount of fats in the diet. One or two glasses of water should be taken one half hour before each meal. Alcohol in all forms should be interdicted. The food intake as a whole should be restricted during the first week or ten days of treatment, in order to give the local treatment a fair opportunity.

DRUGS.—In the beginning, the bowel should be cleared of all irritating hardened feces, and products of intestinal fermentation or putrefaction. For this purpose 1 ounce of magnesium sulphate in a glass of water is given before breakfast, followed by a colonic irrigation of bicarbonate of soda or normal saline solution at 100° F. Or castor oil may be given at night, followed by a saline cathartic in the morning.

Medicines, taken by mouth, are so diluted by the intestinal contents or decomposed by the digestive juices that one may well question any potency they may exert in the lower colon. However, antifermentatives seem to be beneficial, as salol, 5 grains, one hour after meals, and 5 grains of ichthyol in an enteric-coated pill.

As the inflammatory process usually involves a large segment of colon, our chief reliance in treatment is colonic irrigations. One of the best of these is aqueous fluidextract of *krameria*, 4 per cent, which is astringent and soothing. Other solutions recommended are 2 per cent ichthyol, 2 per cent extract of *hydrastis*, 2 per cent *argyrol*, and silver nitrate 1:10,000 to 1:20,000. These solutions are used in quantities of 1 to 2 quarts at a temperature of 105° to 110° F. in the irrigator; the irrigations being repeated at intervals of three or four days. After the irrigating fluid has come away in two or three hours, from 4 to 8 ounces of warmed olive oil, instilled and retained in the bowel, is very beneficial in soothing and protecting the inflamed mucosa. It is an especially valuable aid in overcoming the chronic invagination of the sigmoid, which is at times associated with hypertrophic catarrh.

If sigmoidoscopic examination reveals any erosions, ulcers or perifollicular

inflammation, direct application to these lesions of silver nitrate, 2 to 10 per cent, argyrol 25 per cent, or tincture of iodine 5 per cent in glycerin, stimulates healing. These topical applications should be made a short time after the colon has been irrigated and at intervals of three or four days.

Chronic Atrophic Proctocolitis.—This is the most common type of chronic inflammation and is usually limited to the rectum and sigmoid. It begins in early life and is noted in increasing frequency from puberty onward. The process consists in a general atrophy of the mucous membrane and its glandular elements throughout the rectum and sigmoid flexure, rarely ascending higher.

Symptoms.—Constipation, indigestion and flatulence are prominent symptoms. When superficial ulcerations are present, diarrhea may alternate with the constipation. The hard dry stools may, in their passage, produce abrasions and superficial fissures in the mucocutaneous tissues of the anus. Consequently burning and pain may follow bowel action and pruritus frequently develops.

Digital examination demonstrates as a rule a roomy ampulla with walls widely separated. The surface feels dry, so that the finger does not glide freely over it. Inspissated hard fecal material can almost invariably be felt in the ampulla, where it may accumulate as an impaction. Pressure and friction of the hard, dry scybala, coupled with diminished secretion, at times produce abrasions and erosions, which becoming infected, result in ulceration, usually superficial and of varying extent.

Proctoscopic examination reveals a bright red mucosa of shiny appearance, with adherent particles of inspissated feces scattered over the surface. Ulceration and granulations are much commoner than in the hypertrophic type. The walls are atonic, the rugæ smoothed out and the valves of Houston prominent.

Treatment.—This is chiefly by diet and local measures. The diet should be generous and of the type usually advised for habitual constipation. Bland laxatives, as mineral oil and agar-agar, are indicated for the constipation, and outdoor exercise, especially golf and horseback riding, should be encouraged. Tuttle found atrophic catarrh frequently associated with obscure syphilitic disease. If the Wassermann test is positive, antiluetic remedies are indicated. Cod-liver oil is a valuable tonic.

LOCAL TREATMENT.—As the inflammatory process is practically limited to the rectum and sigmoid, the entire affected field can be observed and treated from below. An enema of a pint or less of normal saline or 2 per cent boric

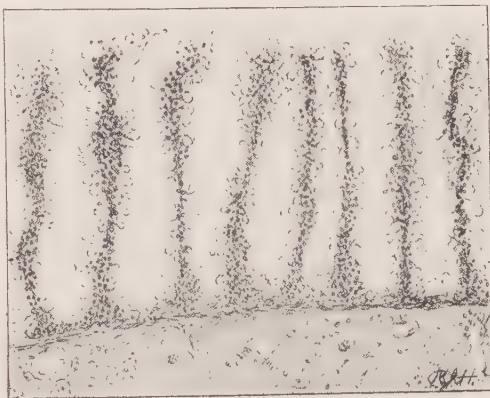


FIG. 197.—ATROPHIC CATARRHAL PROCTITIS.
Specimen showing atrophy and exfoliation of epithelial cells and decrease in intertubular substance.

acid, administered just after the morning bowel action, flushes out of the rectum and sigmoid residual tenacious mucus and inspissated feces. An alkaline solution, as $\frac{1}{2}$ per cent bicarbonate of soda, is more efficacious in removing tenacious mucus.

The best means of applying medicated solutions is to introduce a proctoscope into the lower sigmoid while the patient is in the inverted position, and pour the solution through the tube. The patient then rests on the left side for ten or fifteen minutes. Three or four ounces thus introduced will by peristalsis and gravity come into intimate contact with all of the diseased surface. The most useful preparations for this purpose are 5 per cent ichthyol in glycerin; iodoform and bismuth in olive oil, and 5 per cent balsam of Peru in castor oil. The injections should be given every third day. Retention enemas of 4 to 8 ounces of warm olive oil given at night are soothing and usually are followed in the morning by a soft, easy stool.

Any granular areas or ulcers within the field of the proctoscope should receive every four or five days topical applications of 5 to 10 per cent nitrate of silver, 25 per cent argyrol or 5 per cent iodine in glycerin.

Perineal cracks and fissures will heal under appropriate cleansing measures. Mercurochrome, 2 per cent, will expedite the healing. Hemorrhoids, which frequently complicate the atrophic catarrh, tend to subside with improvement of the proctitis. In any case, their removal should be deferred until the disease is under control. Otherwise the operative wounds are prone to become infected, their healing protracted and treatment of the major condition interfered with.

HEMORRHAGIC COLOPROCTITIS

This is a comparatively rare form of inflammation of the bowel, usually encountered in young adults, but it may occur at any age.

The *etiology* is obscure, but the symptoms and course of the disease strongly indicate that it is an infection, the distinctive nature of which has not been determined; developing in persons otherwise healthy.

Symptoms.—The onset is usually sudden with diarrhea, the dejecta consisting mainly of blood. The temperature is normal, or elevated one or two degrees. When the colon is involved, griping may be present. The disease may be limited to the rectum, especially its lower portion, or involve the entire colon, but rarely passes beyond the ileocecal valve. When the disease is confined to the rectum, the patient may be constipated, although the bloody movements may number five or six in twenty-four hours; but if the sigmoid and colon are also involved, as many as twenty diarrheal actions may occur in a day.

In rectal or rectosigmoidal involvement the disease may run a protracted course of months or years, but extensive involvement of the colon may prove quickly fatal. Secondary anemia, weakness and emaciation are progressive.

Diagnosis.—Diagnosis is made on the history of melena and by sigmoidoscopy. In the acute cases the mucosa appears uniformly inflamed, oozing blood

from its spongy surface. In the chronic cases, the mucosa may present a granular appearance with large or small areas of superficial ulceration.

The condition is to be differentiated from amebic and bacillary dysentery by finding their respective causes by smears or cultures of the stools; from multiple polyposis by proctoscopy, and from a fungating neoplasm by proctoscopy, x-rays of the colon and discovery of an abdominal tumor. The very serious nature of this malady is illustrated by two cases occurring in the author's practice.

M. B., male, aged seventeen years, always well and strong, had been passing bright blood in the stools during two months before consultation. Then bowel actions numbered ten daily, he felt very weak and had lost 12 pounds in weight. Improvement followed local and general treatment, but a few months later there was a severe relapse, with profuse bleeding, prostration and reduction in weight from 128 pounds to 90 pounds in four months. All laboratory tests failed to determine the etiology. Two transfusions of blood at this time worked an almost miraculous change. All symptoms abated at once, the mucosa became nearly normal in appearance and in three months the patient gained 56 pounds in weight and has remained clinically well.

The other patient, R. V., male, aged seventy-nine years, without previous complaint except constipation and occasional retention of urine, had an urgent desire to move his bowels twelve hours before admission to the hospital and passed a large quantity of blood, "two or three pints," he stated. Physical examination showed a man of large frame, fairly well nourished, but pale and anemic. The abdomen was soft, not tender, and no masses were palpable. Proctoscopy revealed considerable free blood in the bowel lumen and a thick film of dark clotted blood covering the mucosa. The latter appeared violaceous and congested. The urine was negative. Blood-cell count was: Erythrocytes, 4,000,000; leukocytes, 30,000 with 89 per cent polymorphonuclears and 1 per cent eosinophils. He vomited all fluids and food ingested. Gastric lavage and intravenous infusions did not check the vomiting. During the next four days the temperature ranged from 98.6° to 100.2°, pulse 88 to 112, respirations 22. On each of the succeeding four days after entering the hospital he passed about one pint of blood, grew rapidly weaker, developed somnolence and muttering delirium, vesical incontinence, and died on the fifth day. Necropsy showed no free fluid in the peritoneal cavity. The stomach, duodenum and small intestine were very pale but without lesions. The entire colon and rectum were bluish black in color. Diverticula of hazel-nut size were distributed along the descending colon and sigmoid. The mucosa throughout the colon was covered with a film of blood-clot as had been observed through the proctoscope, but no gross ulcers or tumors were present. Histologic sections demonstrated acute inflammation, the colon being involved equally with the diverticula.

Treatment.—Cure of hemorrhagic proctocolitis is very difficult in some cases. When the disease is limited to the lower portion of the rectum the hemorrhage is easily controlled. Mummery obtained good results by swabbing the hemorrhagic area with fuming nitric acid, under anesthesia. Small areas are

treated at one time. Applications are made carefully to avoid burning too deeply and any excess acid is sponged away. The acid, by producing a superficial fibrosis and scarring, toughens the mucosa and prevents bleeding. Mummery considers the best method to be electric ionization of the bowel with a solution of zinc sulphite. One or two treatments usually control the bleeding but further treatments are necessary to prevent recurrence.

Other methods of checking the hemorrhage are irrigations with strong solutions of witch hazel and injections into the rectum of silver nitrate, beginning with $\frac{1}{2}$ to 1 grain to the ounce and gradually increasing the strength as tolerated.

When there is extensive involvement of the colon, thromboplastin or similar agents may be given by needle to increase the coagulability of the blood. Transfusion of blood is most valuable and was a life-saving measure in the first case cited. If these measures plus astringent irrigations fail to control hemorrhage, in fulminating cases prompt surgical intervention becomes imperative. The best type of operation is an ileostomy which diverts the fecal current and provides a stoma for irrigating the colon from above.

Hill's patient, however, succumbed the day following an ileostomy. The patient, a physician aged thirty-four years, had had rectal bleeding for seven weeks. Necropsy showed extensive ulceration of the cecum, ascending and transverse colon. The ulcers were irregular and varied in size up to the largest which was 5 by 6 centimeters in diameter, and extended down to the muscular coat. Their edges were greatly undermined, the ulcers in some instances communicating with one another beneath a bridge of mucosa.

CHRONIC MUCOUS COLITIS

This condition is also termed *mucomembranous coloproctitis* and *myxorrhoea coli*.

The affection may be defined as a chronic inflammation of the mucosa of the colon, sometimes extending into the rectum, characterized by the production of excess mucus and its discharge, either alone or with the feces, in jelly-like masses, in the form of a pseudomembrane or as a complete cast of the bowel; the passages in some cases occurring at irregular intervals and usually preceded by some griping and tormina.

Etiology.—As to the nature of this malady, two divergent views are entertained. According to Nothnagel and the majority of neurologists, it is a secretory neurosis due to some obscure condition of the vegetative nervous system in which endocrine glandular dysfunction may also play a part. In this view there is no lesion of the colon, primarily at least. Supporting this contention is the frequent occurrence of the affection in neurotic individuals who are anemic, chlorotic or undernourished, although many instances are observed in the plethoric and well nourished. However, this view is negated in large degree by the fact that the proportion of cases of mucomembranous colitis recorded in institutions for nervous diseases, the insane and epileptic, is not greater than is

noted amongst persons not so afflicted. It seems much more logical to consider the nervous symptoms to be a result of the bowel lesions, rather than their cause. Although a small percentage of the cases apparently have basically a nervous origin, in the majority the primary condition seems to be in the intestinal mucosa, and local.



FIG. 198.—MUCOUS COLITIS.

Spastic descending colon, simulating ulcerative colitis. Male, aged twenty-one years.

This view is championed by von Noorden and many others who consider it an inflammation of the colon, conforming in pathology and in most of its clinical aspects to chronic hypertrophic coloproctitis. The best results are obtained by those who treat the affection on this basis.

Cawadis distinguishes two conditions, namely, mucomembranous colitis and nervous spasmomyorrhea, which have the same clinical manifestation, the spasmomyorrheic syndrome constituted by spasm of the colon and hypersecretion of colon mucus. Both pain and constipation are due to the spasm.

Cawadis considers that an overstimulation of the parasympathetic centers which innervate the large bowel (vagus for right colon, nervus pelvici for left colon) causes spasm of the muscular coat and hypersecretion of mucus by the glands.



FIG. 199.—MUCOUS COLITIS ASSOCIATED WITH NON-ROTATION OF COLON.
Female, aged sixty-four years.

According to the nature of the abnormal nervous impulse or abnormal toxic agent, he groups nervous spasmomyorrhea cases as: (a) Reflex—the abnormal nervous impulse originating in any diseased organ, as gastric or duodenal ulcer, disease of the gall-bladder, and, in women, of the genital organs; (b) from the

central nervous system, such as a cerebral tumor, meningitis, or more frequently, purely psychic; (c) toxic, from endocrine glandular deficiency; a definite poison, such as tobacco, or anaphylactic shock in patients sensitized toward certain substances, especially proteins. In true mucomembranous colitis there is a segmentary disease of the colon, chronic proctitis or chronic appendicitis; while in nervous spasmomyorrhea the colon is primarily normal.

The disease affects both males and females of all ages, but is encountered most frequently in nervous women under forty years of age. Of course, persons afflicted with a nervous condition may be the victims of mucous colitis. Under such circumstances, it may be regarded as a complication rather than a cause or a result. On the other hand, a neurotic state and mental depression frequently develop as a result of the condition.

The causes are essentially the same as those already enumerated for hypertrophic coloproctitis. To these may be added endocrine glandular dysfunction and reflex disturbance or infection of the intestine from foci in the gall-bladder, appendix, teeth or tonsils. Tuttle and McWilliams have emphasized the influence of the chronically inflamed appendix in increasing or depressing intestinal peristalsis and stimulating secretion of excess mucus. Ablation of the diseased appendix relieved the symptoms in several cases reported.

Mechanical action or obstruction is in many cases the chief or only factor responsible for this special form of colitis. Most notable causes in this class are enteroptosis, adhesions and bands, movable kidney and extra-intestinal tumors. As a result of inflammation of the adnexa, local or pelvic peritonitis, adhesions or bands are formed, which interfere with intestinal peristalsis. One of the chief sites of such adhesions in this condition is the sigmoid flexure. Bands or adhesions sometimes bind this segment so firmly to the pelvic organs or walls that it cannot ascend into the abdominal cavity when distended with gas and feces. Consequently stasis ensues which initiates a catarrhal inflammation.

The persistent traumatism and irritation of the ascending colon by the excursions of a movable kidney has been suggested as a cause of localized colitis. The frequent association of movable kidney with enteroptosis suggests that both conditions are operative at the same time.

Pathology.—As this disease is not fatal, few opportunities are offered for study of the pathological anatomy. The muscular walls are usually thin and atrophied. The mucosa may appear normal or be congested and ulcerated. The mucous glands and follicles are hypertrophied and distended with mucus. The mucus is glairy and tenacious and is discharged in the form of jelly-like masses, tape-like shreds or sometimes as a pseudomembranous cast of the bowel, varying in length from a few inches to 2 or 3 feet, and may be very thin or as much as $\frac{1}{4}$ inch in thickness. The casts, which may be mistaken for intestinal parasites, result from the coagulation of the secreted mucus in layers. The laminated pseudomembrane thus formed is composed of a structureless albuminoid material, containing degenerated epithelial cells, leukocytes and bacteria, and occasionally the whole epithelial lining of the mucous follicles.

Symptoms.—The distinctive symptom is the discharge of mucus from the bowel. Some patients, following a period of constipation, have diarrhea, the small stools containing the excess mucus. Typical cases are characterized by "attacks" which may occur monthly or only two or three times a year. For several days preceding the attack the patient is constipated, depressed and gloomy. Abdominal unrest, distention and griping finally culminate in a paroxysm when the bowels act, expelling mainly mucus, in the form of shreds, membrane or a cast. This relieves the tormina, but soreness may persist a few days, although the patient feels generally better. The explanation of the

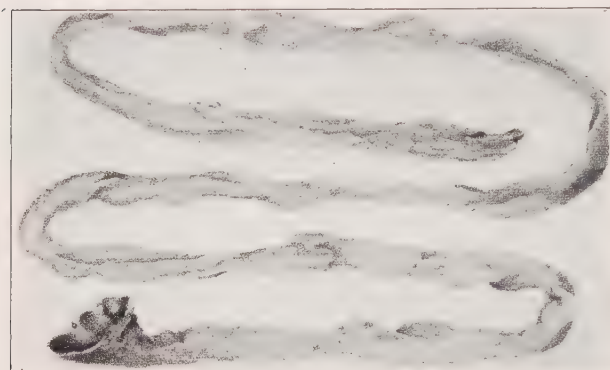


FIG. 200.—MUCOUS CAST OF THE BOWEL MEASURING ABOUT 35 INCHES.

Several inches were removed for sectioning. (Courtesy of Charles Goldman and *Med. J. & Rec.*, N. Y., Dec. 14, 1925.)

symptom-complex of the acute attack is not clear. Apparently either the mechanical interference or intestinal spasm results in an accumulation of mucus which eventually, by irritation, produces violent peristalsis. This causes the severe pain and final expulsion of the mass.

Associated symptoms, apart from the acute attack, may be summarized under the caption "nervous dyspepsia," consti-

pation, generally spastic, and malnutrition. Nervous manifestations are prominent: Headache, migraine, neuralgia, neurasthenia, hypochondriasis and tachycardia.

Diagnosis.—A history of typical attacks, and finding the characteristic mucus in the stools may determine the diagnosis. To discover associated lesions a thorough physical examination is necessary. The abdomen is examined particularly for spasm or thickening of the colon, appendicitis, tumors and ptosis. Functional tests of the stomach and gall-bladder may be made if deemed necessary. The rectum is examined and sigmoidoscopy frequently reveals the hypertrophic catarrh or a local lesion. An x-ray examination shows the degree of enteroptosis, points of stasis, and may reveal definitely the segment of colon affected.

In cases of nervous spasmomyxorrhoea, every effort should be made to find the reflex or toxic cause, psychic disturbances or organic disease of the central nervous system.

Treatment.—As the condition is chronic, a long course of treatment is necessary to effect a cure. Those who hold that it is a neurosis, advise baths, electricity, strychnin and arsenic as tonics for the nervous system, and luminal,

bromids or other sedatives for the mental condition. Change of residence, travel and amusements may be the requisite to recovery in some cases.

At the outset it is essential to ascertain whether adhesions, bands, a chronically inflamed appendix or an extra-intestinal tumor is present. Either mechanically or reflexly they may be primarily responsible for the condition. Appropriate therapy may relieve the colitis temporarily, but it is prone to recur unless these primary causes, if present, are corrected by suitable surgical intervention.

The treatment in general is much the same as for chronic hypertrophic colitis. The diet is very important. It should be nutritious and largely of the nitrogenous type, with little residue. Vegetables containing cellulose, bran and other irritating substances should be eliminated from the diet. General hygienic measures and outdoor recreation are indicated. For the mentally depressed physical and mental occupation are essential; and tonics for those suffering from general debility. Constipation is relieved by bile salts and mineral oil; fermentation and diarrhea by diet, a 5-grain enteric coated pill of ichthyol, salol, 5 grains after meals, or bismuth subcarbonate, 20 grains, before meals.

Colonic irrigations once or twice weekly are indicated to prevent accumulation of mucus. Several gallons of a 0.5 per cent solution of bicarbonate of soda at 105° F. should be used. An enema of warm olive oil, 4 to 10 ounces, administered from a fountain syringe to the patient in the knee-chest position before retiring, and retained overnight, is an excellent soothing application.

During the acute attacks, relief of pain is obtained by hot stupes to the abdomen; atropin and codein by needle. In exceptional cases, where the treatment outlined is not effective, a valvular cecostomy may be established as a more direct means of local treatment.

REFERENCES

HEMORRHAGIC COLOPROCTITIS

HILL, T. C. *A Manual of Proctology*, Philadelphia, Lea & Febiger, 1923.

CHRONIC MUCOUS COLITIS

CAWADIS, A. E. *Diseases of the Intestine*, London, Ballière, Tindall & Cox, 1927.

CHAPTER XIV

CHRONIC ULCERATIVE COLITIS

In 1875, Wilks and Moxon, and, in 1888, W. Hale White described "simple ulcerative colitis." Thereafter the disease received scant attention in medical literature until the communications of Hawkins in 1909, Albu in 1914, and Logan in 1919. Since then it has been the subject of intensive study and various names have been applied, among which are: Non-specific or idiopathic ulcerative colitis, colitis suppurativa, colitis ulcerosa, rectocolitis gravis.

The disease is characterized by an acute or gradual onset, most frequently between the twentieth and fortieth years of life; ulceration of the colon as the essential pathologic condition; bloody diarrhea, either continuous or with remissions as the cardinal symptom, resulting in anemia, emaciation and debility; a protracted course of many months or years, and a guarded prognosis.

Age.—The age incidence in the author's series of one hundred cases was:

<i>Years</i>	<i>Cases</i>	<i>Years</i>	<i>Cases</i>
1-20.....	8	41-50.....	12
21-30.....	43	51-60.....	8
31-40.....	25	61 plus.....	4

The youngest patient was six years of age and the oldest sixty-six.

Helmholz reported eleven cases of chronic ulcerative colitis in children, the age of onset in seven being at four, seven and eleven years respectively in three cases, and at ten years in four. Three of these patients had symptoms for less than a year, the other four from one to seven years. Thus, young people, subject to exposure, infections and indiscretions in diet comprise the majority of cases.

Sex.—In our series males numbered fifty-six and females forty-four.

Etiology.—There are a number of bowel conditions presenting a clinical picture very similar to chronic ulcerative colitis. Proctoscopy and microscopy; x-ray, bacteriologic and serologic study serve to differentiate the known specific infections of the larger bowel. Present consensus of opinion is that infection causes the disease, although it is still debatable whether a specific organism is the causal agent. Favoring the theory of infection are the fever and prostration often present at the onset, and later, septic complications, especially arthritis. Secondary infection of the ulcers of amebic or bacillary dysentery by the normal intestinal flora undoubtedly accounts for the markedly increased incidence of ulcerative colitis in many sections since the World War. In only seven of our cases was there a history of amebiasis; no amebæ or cysts were found in the

stools, and full courses of emetin gave temporary benefit in only two cases. In our series stained smears direct from the ulcers generally showed the normal intestinal flora, either Gram-positive or Gram-negative organisms predominating. Cultures from the same source in 15 per cent of the cases grew *B. coli* regularly, together with various strains of streptococci and staphylococci, thus suggesting that the normal intestinal flora or types not differentiable from them are the active infective agent. Cultures of the blood are usually negative, but in seventy cases, Crohn obtained positive blood cultures in three acute cases. In two of these an enterococcus was isolated from the blood and stool.

Bargen has made a commendable experimental and clinical effort to discover a specific organism. In forty-five of sixty cases of chronic ulcerative colitis, he isolated, as the predominating organism in cultures from the depths of the ulcers, a Gram-positive, lancet-shaped diplococcus, always in groups of two or four, and occasionally with a capsule, thus morphologically resembling a pneumococcus. The diplococcus has definite cultural characteristics and on blood agar it grows as an alpha hemolytic streptococcus. Cultures of stools did not yield the same organism, but it was often found as the predominating bacterium in cultures of the rectal discharge of mucus, pus and blood. Cultures made from the sound colonic mucosa of twenty healthy patients showed diplococci of similar characteristics in only one instance. He also isolated the diplococcus from the tonsils and apical abscesses of the teeth. In some instances, after removal of these foci, temporary aggravation of the colitis was followed by striking and often permanent improvement.

Pure cultures of the diplococcus injected intravenously in dogs and rabbits produced in one-third of them colonic lesions like those of chronic ulcerative colitis in man. Nine rabbits were fed for two weeks on a vitamin-free diet. All were injected intravenously with a dextrose brain broth culture of the freshly isolated diplococcus. All the animals were dead in five days, eight showing colonic lesions, and three of these had in addition empyema of the gall-bladder from which the diplococcus was isolated in pure culture. No control experiments, using other bacteria, are mentioned in the reports.

The experimental and clinical work of Bargen, Logan and Buie seems quite convincing as to the specific nature of the diplococcus described in at least a certain proportion of cases. Nevertheless, until the experience of other workers confirms their findings, the question as to whether or not the diplococcus of Bargen is the specific etiologic factor in chronic ulcerative colitis must be held *sub judice*.

Bassler believes that bacteria are the main factor in the etiology; that pyogenic hemolytic and non-hemolytic streptococci are the chief cause; that the streptococci work symbiotically with the Welch bacillus or the Gram-positive diplococcus; that a parasitic or pyogenic type of *B. coli* may be the only infecting organism in a minor number of cases which are comparatively easy to control, and that the Bargen organism is identical with the Gram-positive diplococcus long ago described by Herter.

Torrey made a bacteriologic study of the stools of fifteen cases of chronic ulcerative colitis. He feels that the bacillus described by Bargaen belongs to the type of enterococcus common in the intestine both in health and disease, and that it probably is a variant of the streptococcus group. He considers that chronic ulcerative colitis is not due to a specific infection, but that strains of different bacteria may cause the same form of ulceration, and that there is an underlying factor which renders the patient susceptible to infection.

Our experience accords with that of Torrey in that our bacteriologists are unable to isolate by culture the diplococcus described by Bargaen.

As Kendall states, "Normal intestinal organisms, or types indistinguishable from them by ordinary methods of study, may multiply with abnormal luxuriance through unusual conditions, extend their normal habitat and crowd out



FIG. 201.—GROSS APPEARANCE OF MUCOUS MEMBRANE IN FOLLICULAR COLITIS.
(Delafield and Pruden.)

some of the existing organisms, eventually leading to abnormal reactions in the alimentary canal, which may be detrimental to the host." Among such "unusual conditions" are food toxins, severe constipation, injuries, surgical operations, pregnancy and labor, and acute infections, especially of the upper respiratory tract.

In the majority of cases no definite *predisposing cause* can be assigned, but in our series the onset dated from dietary indiscretion in six cases; severe constipation in five; exposure in three; pyorrhea and root abscesses, influenza, injury and pregnancy, two cases each. It followed parturition in one case and a surgical operation in three cases. These factors are mainly significant in temporarily lowering normal resistance during which the normal intestinal bacteria may assume an unusual virulence.

McCarrison has demonstrated that diet deficient in the vitamins and salts contained in fresh vegetable foods is an important factor in disturbing perfect function of the gastro-intestinal tract, and thus lowering the level of body resistance. In monkeys, after a deficiency diet, introduction of entameba produced pronounced colonic disturbances marked by severe diarrhea without ulceration. It is quite probable that disturbances of metabolism and avitaminosis are important causal factors in a minor group of cases.

Pathology.—The disease process is that of a simple chronic inflammation which, as a rule, begins in the rectum and sigmoid. In about 20 per cent of cases the disease is limited to these segments; in the majority higher levels or the entire colon are involved, and in a few instances there is a retrograde infection of the terminal ileum.



FIG. 202.—RADIOGRAM SHOWING NON-HAUSTRATION AND CONTRACTION OF ENTIRE COLON INVOLVED IN CHRONIC ULCERATIVE COLITIS.

Very prompt and permanent improvement followed colectomy.

The early stages of general hyperemia and edema of the bowel mucosa are succeeded by diffuse miliary abscesses, the rupture of which results in the characteristic superficial ulcers. If the disease is arrested at this point, the mucosa viewed through the proctoscope presents a granular appearance. In some cases confluence of the miliary ulcers and their secondary infection produces larger irregular ulcers and destruction of the mucosa. The large chronic ulcers

may have a grayish necrotic base or be fresh and hemorrhagic. In the majority of cases the inflammatory process is practically limited to the mucosa. If cure is effected in this stage, the mucosa grossly appears normal or only scattered superficial pale areas of scar tissue mark the site of former ulceration, and no marked structural changes in the other coats of the bowel occur.

In long-standing cases, the infective process may extend into the submucosa and muscularis. In consequence of the inflammatory reaction, there is fibrosis and thickening, resulting in the characteristic stiffening of the bowel wall and contraction of its lumen. This diagnostic feature can be seen through the procto-

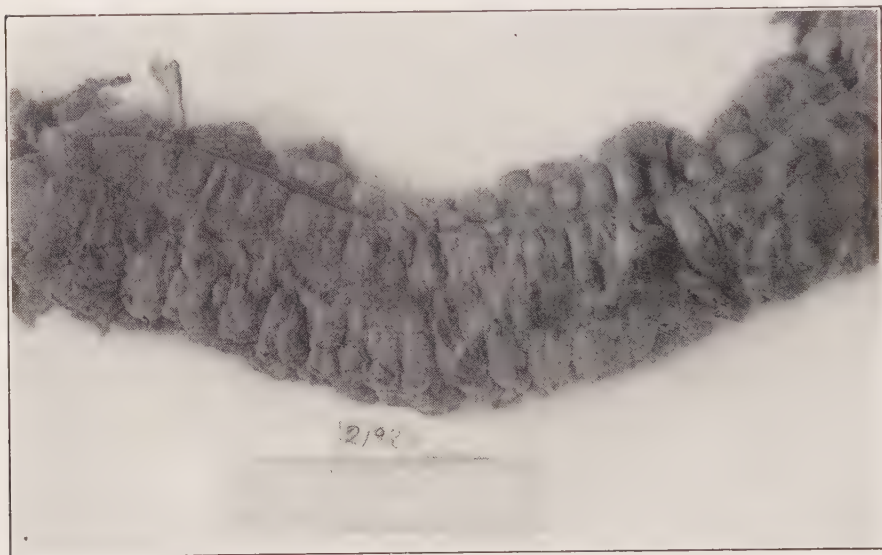


FIG. 203.—EXTERNAL SURFACE OF RESECTED COLON.

scope and accounts for the non-haustrated tubelike appearance of the colon on roentgenograms.

Actual stricture formation in a functioning colon is rare, but a rectal stricture of 2 centimeters diameter developed in two of our cases. Perforation of the bowel wall through the base of an ulcer has occurred in a few instances, resulting in abscess or peritonitis, which is usually fatal. Great care must be exercised in instrumental examination or in handling the colon during operation lest its friable wall be perforated or ruptured. Rectovaginal fistula has developed in a few cases. This unfortunate complication in one of our patients seemed to have resulted from the clumsy use of the rectal irrigating tube. Erosion of a vessel in the base of an ulcer may cause a massive and alarming hemorrhage. Inflammatory enlargement of the mesenteric lymph-nodes is of frequent occurrence and it has been suggested that in some cases exacerbations of the disease are due to reinfection of the colon from this source. Diffuse carcinomatous degeneration of the ulcerated mucosa was observed in two cases at the Mayo Clinic. Multiple

polyps developed secondarily in eight of our cases, arthritis complicated five others and massive hemorrhage occurred in one. Abscess of the liver has been reported in the literature as a rare complication. Fatty degeneration of the liver and other abdominal viscera are occasional late manifestations.

Both the gross and microscopic changes in the colon are well illustrated by a patient seen by the writer in consultation and later operated upon by Auchincloss at the Presbyterian Hospital.

Case History.—J. M., a man, aged twenty-eight, had severe ulcerative colitis of three years' standing when first examined in 1917. Weight loss was 60

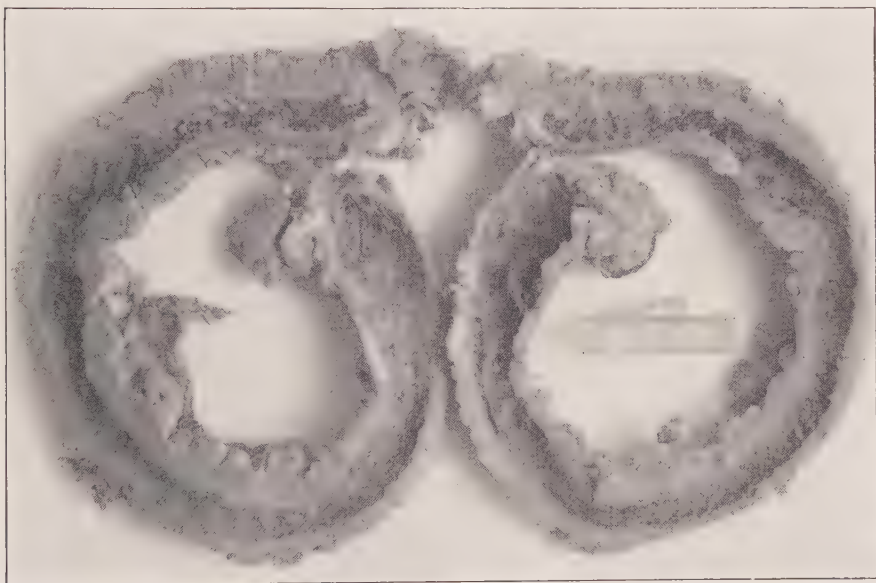


FIG. 204.—PROXIMAL PORTION OF COLON.

Wall distended and thin; distal portion contracted and wall apparently thickened.

pounds, and he was weak and miserable. All laboratory tests were negative. Appendectomy, cecostomy and enterostomy were performed at one time. Considerable improvement ensued, then the bowel condition remained stationary, and arthritis and contractures of several muscles developed. Colectomy was performed in October, 1918, with most favorable results. The patient gained 37 pounds in weight and felt practically well. Nevertheless, the residual ulcerated rectum was still unhealed two and one-half years after operation. At this writing, ten years after colectomy, he has maintained his general improvement, and the rectal ulceration is better, but it has not been deemed wise to close the ileostomy by performing ileosigmoidostomy.

Pathological report on the resected colon:

GROSS APPEARANCE.—The specimen consisted of a resected colon, 37 centimeters long, and 3 centimeters in diameter. Its peritoneal surface was somewhat

blood-stained and there was considerable fat in the appendices epiploicæ. The distal end of the colon was much contracted. Longitudinal section revealed the proximal end distended, the wall thin. The mucosa was apparently absent, roughened by fibrin. There were blood coagula irregularly throughout the whole lumen. The roughening of the lining with deposition of fibrin and apparent ulceration extended to within 8 centimeters of the distal end. Here, the mucosa was thrown up into irregular hillocks, was not ulcerated, and was covered with fine, irregular patches of fibrin. No ulcerated surface was apparently deeper

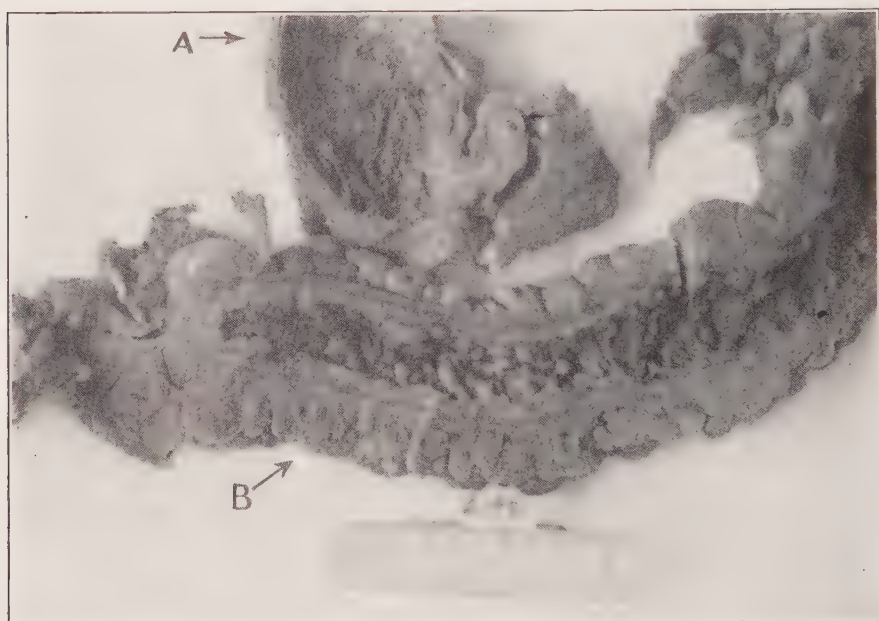


FIG. 205.—PORTION OF FIG. 204 ENLARGED.

Contrasts *A*, roughening of lining with deposition of fibrin and apparent ulceration of proximal end with *B*, intact mucosa of distal end.

than the mucosa, except a few small isolated points where the ulceration may have invaded the submucosa (Fig. 205).

MICROSCOPIC EXAMINATION.—Most of the sections taken through the wall of the intestine showed no direct ulceration, but a rather atrophic mucosa in which there were a number of widely dilated glands filled with leukocytes. Some of these gland spaces had lost part of the epithelial lining, and the resulting appearance suggested a small abscess (Fig. 206). The submucosa and muscularis were edematous, and were infiltrated with scattered leukocytes, round and plasma cells and evidence of connective-tissue proliferation. External to the muscularis were a number of dilated lymphatic vessels. One section showed a distinct area of ulceration on the lumen surface with complete loss of mucosa and replacement by granulation tissue (Fig. 207). In the vicinity of this ulcer

there was a group of foreign body giant-cells with irregularly rounded spaces in their cytoplasm. The process had no specific characteristics.

The diagnosis was ulcer of the intestine.

The frontispiece shows the proctoscopic appearance of various types of mucosal pathology.

Symptoms.—There is usually a history of previous attacks. The chronicity of the process is indicated by the period the disease had existed. In our series

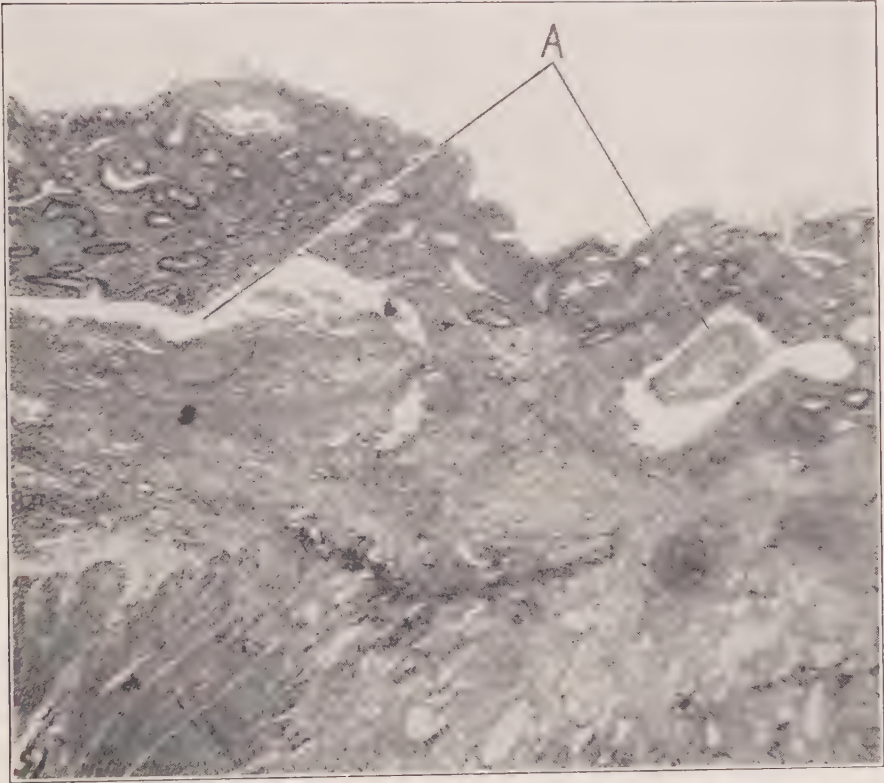


FIG. 206.—PHOTOMICROGRAPH OF SECTION OF COLON WALL.

Rather atrophic mucosa, dilated glands filled with leukocytes, loss of epithelial lining of some glands. Resulting appearance suggests small abscesses at *A*. Submucosa and muscularis are edematous, infiltrated with round and plasma cells, and present evidences of connective-tissue infiltration.

of one hundred cases, symptoms had been present under one year, thirty-eight cases; from one to five years, fifty-two cases; from six to ten years, eight cases; and from eleven to fifteen years, two cases. The average period was two years and three months. Remissions of weeks or months characterized many of the protracted cases.

In sixty-five of our cases the onset was acute in forty-seven and gradual in eighteen. The chief symptom is the passage of blood, pus and mucus in the

stools. The number of stools varies from three to twenty or more per day. Passages occur mainly in the morning or evening, seldom at night. When the disease is limited to the rectum and sigmoid, some patients are really constipated, passing discharge only. Actual diarrhea usually occurs when the colon is involved and the stools may contain the undigested remnants of food ingested only three or four hours earlier. Fresh or old blood is present or predominates in the discharge of the great majority of cases.

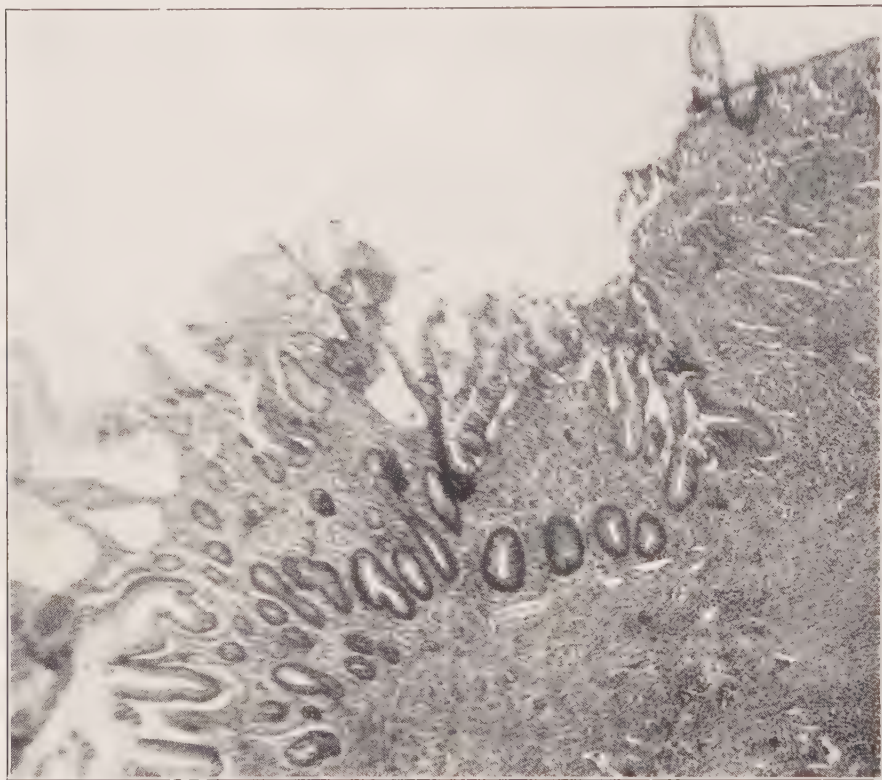


FIG. 207.—PHOTOMICROGRAPH OF SECTION OF COLON WALL.

Note distinct area of ulceration and replacement of mucosa by granulation tissue.

Intestinal colic and urgency before bowel action are usual symptoms, and tenesmus when the rectum is extensively involved. In acute cases the abdomen is frequently spastic; when the abdomen is soft, the colon feels firm and tender to palpation.

Loss of weight is not striking in all cases. In one hundred cases it was less than 10 pounds each in forty-two cases, from 10 to 20 pounds in thirty-eight cases, from 21 to 50 pounds in sixteen cases, and over 50 pounds in four cases. The greatest weight loss was 80 pounds, the average being $17\frac{1}{2}$ pounds.

The blood-picture is not characteristic, but usually is that of a secondary

anemia. The hemoglobin index varies from 50 to 90 per cent, but may be as low as 30 per cent in cases of severe melena. The leukocytes range from 9,000 to 29,000, the proportion of eosinophils being about 3 per cent. The Wassermann reaction of the blood was positive in only four of ninety cases in which it was taken, so syphilis is not an important etiologic factor. Analysis of the gastric contents usually shows an acidity within the normal range, but sometimes marked subacidity. Urinalysis gives no marked deviation from the normal except a regular excess of indican.

Course.—Clinically the disease is acute and fulminating, or more commonly remittent with acute exacerbations. The fulminating variety is marked by frequent stools, reaching twenty or thirty per day, abdominal cramps and a temperature of the septic type up to 104° . There is also a rise of temperature when exacerbations occur in the remittent type of the disease and with complications, such as perforation with abscess. These cases frequently do not respond favor-



FIG. 208.—CAMERON MAGNIFIER ATTACHED TO YEOMANS' PROCTOSCOPE FOR CLOSE INSPECTION OF MUCOSA.

ably to any treatment, short of an ileostomy to divert the fecal current completely. Otherwise they may end fatally in a few weeks, although a few subside. In the remittent type which comprises the majority of cases, the onset is gradual and the course progressive.

A notable characteristic of the disease is the tendency to recurrence after a period of months or years of symptomatic and clinical cure. This may be due to a new infection but more probably occurs when the immunity conferred by the previous attack is lost.

Diagnosis.—The diagnosis is easily made on the (a) history; (b) laboratory examination of the stools; (c) sigmoidoscopy; and (d) roentgenograms of the colon.

The sigmoidoscopy and x-rays are our main reliance. Before their advent, diagnosis was usually made postmortem. Direct inspection of the bowel through the sigmoidoscope is essential. It reveals the character and extent of the ulceration, which almost always begins in the terminal colon and rectum; we obtain material direct from the ulcers for smears and cultures; differentiate other diseases and conditions characterized by rectocolonic ulceration, and rule out lesions having frequent bowel discharges, such as benign and malignant tumors and stricture.

The roentgenologic picture of the colon after a barium clysma is characteristic. In the acute stage there is mottling and marginal feathering, due to hyperperistalsis and spasmodic contraction. If the disease is less acute or subsiding, the x-ray findings frequently show a comparatively normal colon, although sigmoidoscopy shows definite ulceration of the mucosa.

In the late stages, when the bowel wall has become thickened and inelastic, non-haustration and contraction produce the typical "gas pipe" appearance. This

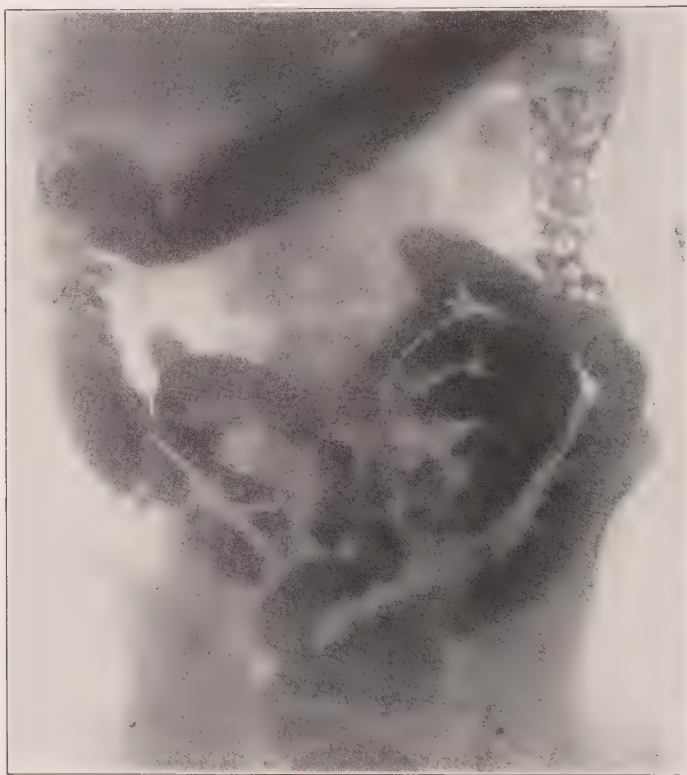


FIG. 209.—RADIOGRAM SHOWING MOTTLING OF ASCENDING COLON, DESCENDING COLON AND SIGMOID.

Probably due to early ulceration and hyperperistalsis.

change is observed especially in the descending colon and sigmoid flexure (Fig. 209), also rather frequently in the transverse colon, and rarely throughout the length of the colon (Fig. 211). When the disease is confined to the sigmoid and rectum, x-ray evidence is valueless in comparison with sigmoidoscopic findings.

As good roentgenograms indicate the extent of the pathologic process, they are of great value in the prognosis and method of treatment, and as a check-up on the progress of the individual case. The x-ray examination should include

the teeth for root abscesses, and the chest for infiltration of the lungs, as some of the protracted cases suggest a latent tuberculosis, although the sputum and stools are negative for *B. tuberculosis*. Visualization of the gall-bladder is sometimes advisable, and it is a focus of infection in some cases.

Prognosis.—The prognosis is always guarded. Some patients respond promptly to treatment; others improve slowly, remain stationary or retrograde, while a few succumb despite our present medical and surgical therapy. Some



FIG. 210.—CHRONIC ULCERATIVE COLITIS.

Radiogram showing spasm in distal colon. Female, aged thirty-six.

patients follow their usual vocations without great effort, but in the majority progressive weakness and chronic invalidism are characteristic. The well-known tendency of the disease to recur after months or years of apparent cure renders the prognosis always uncertain.

From 1920 to 1927, Barga reports that at the Mayo Clinic there were twenty cases of chronic ulcerative colitis in which malignancy had developed, the youngest patient being twenty-one years of age. The average duration of the colitis was six years. A definite change of symptoms was noted in most of the cases developing malignancy, such as, recent rapid loss of weight, increased

intensity of pain and cramps along the course of the colon, clinical signs of various degrees of obstruction, sudden increase in bloody discharge and cachexia. Radiograms showed definite filling defects in eight of the twenty cases. In all of the cases the proctoscopic picture was that of severe chronic ulcerative colitis; in seven, benign polyps were present in the rectum, and in seven grossly malignant lesions were seen through the proctoscope. In four of the latter, polyps were

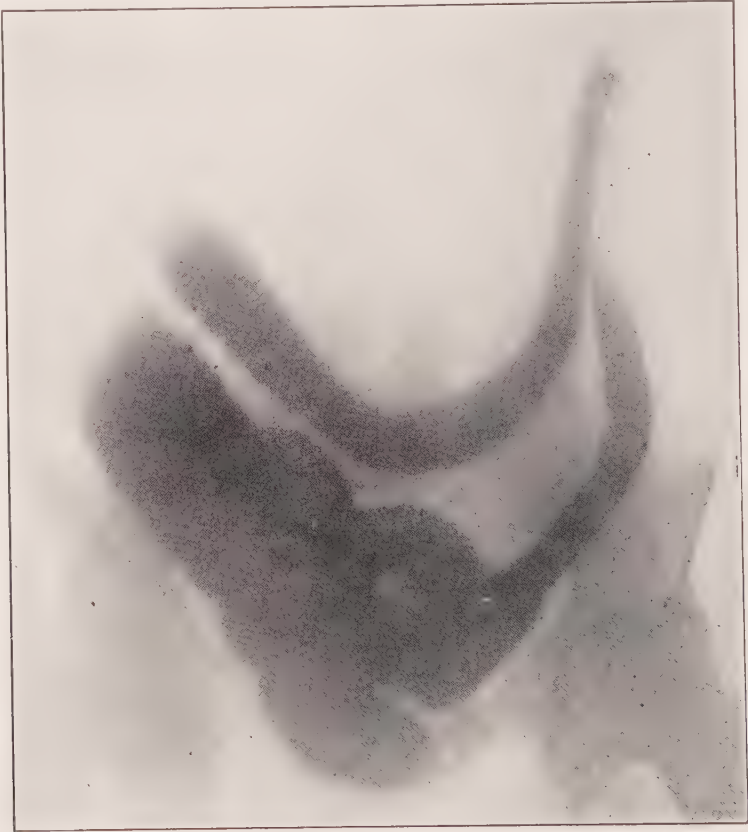


FIG. 211.—CHRONIC ULCERATIVE COLITIS.

Radiogram showing haustra absent and marked contraction of transverse and descending colon and sigmoid, so-called "gas-pipe" colon. Ulcerative colitis of eighteen months' duration. Ileostomy indicated and advised. Patient, aged twenty-one, refused operation.

also present. The carcinomata were multiple in six cases and in one case there was diffuse carcinomatosis along the entire length of the colon. Of the twenty cases, fourteen were of proved carcinoma, two of lymphosarcoma and one of lymphatic leukemia. Of fifteen patients operated upon, twelve died; seven of generalized peritonitis, two of pneumonia and three of metastases. This experience shows that the prognosis is grave when malignant disease is superimposed on chronic ulcerative colitis.

Treatment.—Successful treatment of this condition taxes the resources of both the physician and the surgeon. In accordance with their theory of the causation of the disease, physicians have treated ulcerative colitis on the principle of a severe infection, a deficiency underlying a metabolic disturbance, or as purely a surgical problem. A combination of these views best conserves the welfare of the patient. Treatment includes general measures, diet, drugs, serums and vaccines and surgery.

Rest.—Relaxation, while lying down for an hour after meals, is important. When the symptoms are not acute, absolute confinement to bed does not limit the number of stools, and in some instances is attended by progressive loss of weight and debility. These patients do better with moderate exercise, but not to the point of fatigue. On the contrary, fulminating cases and those with active bleeding require strict confinement to bed until the acute phase has passed.

Diet.—In an infectious disease that is rapidly depleting, one of the chief factors in maintaining the patient's strength and raising resistance is a nutritious diet. The diet should be liberal, well balanced and contain all the elements necessary for good health. It should be of high caloric value and contain calcium and the vitamins. The type of diet is the most important factor in regulating the intestinal flora. Nevertheless, the majority of patients do best on an ample mixed diet with a minimum of roughage from which only highly seasoned and irritating articles are excluded. Meats, except pork, liver, eggs, fermented milk, cream, well-cooked cereals, boiled rice, carrots, creamed spinach, baked bananas, stewed fruits, orange and tomato juice should be included in the diet. In the acute phase of the disease, food having the least possible residue should be taken, but during remissions a certain bulk to the residue is beneficial, provided it is not irritating roughage. If analysis of gastric contents shows hypo-acidity, 10 to 15 minims of dilute hydrochloric acid in a glass of water should be sipped with meals.

Drugs.—A large variety of drugs have been used with benefit in some cases and no apparent effect in others. It is impossible to predict the effect of any drug in a given case. Some form of opium will relieve pain and check diarrhea. Hot abdominal stupes allay the pain in some cases. Tannigen (5 grains) and teaspoonful doses of bismuth subcarbonate every two or three hours have been used for the same purpose.

Logan obtained definite remissions in about 5 per cent of a series of cases by the administration by mouth of 10 to 15 minims of tincture of iodine in a glass of water three times a day. The theory of its action is stimulation of leukocytosis.

Kaolin, a finely powdered clay that is non-irritating and non-toxic, in ounce doses mixed with sufficient water to form a paste, and taken three or four times a day, seems to protect and cleanse the mucosa and act as an absorbent. It may also be injected into the colon through a cecostomy or appendicostomy opening.

The anilin dyes, gentian-violet, neutral acriflavin and mercurochrome in enteric coated pills, have all been used. It is still uncertain whether they have positive value. Cases reported as benefited or cured by the administration of the arsenicals, stovarsol and arsphenamin, were probably in most instances parasitic infections. Yet, one of our long-standing cases had a definite remission for one year after three doses of neo-arsphenamin intravenously. An exacerbation then occurred, and repetition of the arsenical was of no benefit.

Local Treatment.—This comprises colonic irrigations, instillations and topical applications through the sigmoidoscope. As a rule, local treatment is not well tolerated by the acutely inflamed and spasmodically contracted colon. After the acute phase of the disease has subsided, local treatment is indicated. The response of the individual patient to colonic irrigations or instillations is very variable. Some patients tolerate them well and respond favorably and promptly to daily irrigations, while others do better with treatments at intervals of two or three days, and in a few patients irrigations seem to irritate the bowel and spread the infection, thus aggravating the condition. Irrigating fluids include plain water at 110° F. normal saline, and solutions of boric acid (2 per cent), sodium bicarbonate ($\frac{1}{2}$ per cent), ichthyol (0.5 to 1 per cent), potassium permanganate (1:10,000 to 1:5,000), witch hazel (3 per cent), argyrol (4 per cent), chloramin-T (1:4,000), silver nitrate (1:8,000), mercurochrome, gentian-violet and neutral acriflavin. Theoretically at least, hypertonic solutions, as sodium chlorid, 1 ounce to 2 quarts of water, are advantageous in producing osmosis from the bowel wall.

Of the older preparations, potassium permanganate has been most valuable in our experience, curing a number of cases where the disease was limited to the terminal colon and rectum. Silver nitrate solution in the later stages should be used not oftener than once a week. By its too frequent use silver may be absorbed, resulting in argyria.

Of the newer preparations acriflavin and gentian-violet are the least irritating and have given us the best results. The dye is selected in accordance with the findings upon staining a smear of the discharge by the Gram differential method. One-third Gram-positive, and two-thirds Gram-negative organisms may be considered as an approximately normal standard. When Gram-negative organisms, the typhoid-dysentery-coli group, predominate, neutral acriflavin acts best; and when the pyogenic Gram-negative bacteria are in predominance, gentian-violet is indicated. In addition, cultures of material obtained directly from the ulcers should be studied for strains of individual bacteria. These dyes are administered in a strength of 1:4,000 in warm water or normal saline solution, as retention enemas of 1 pint. Treatment is given once or twice daily, or every other day. Unless the response to these dyes is prompt and favorable, little benefit can be expected from them and their continued use irritates and is injurious.

Bassler believes that mercurochrome intravenously is excreted through the terminal ileum and large bowel. He used it with benefit in several cases, but

in one patient, a young man, anuria ensued after the second dose of mercurochrome. Because of its possible toxic effects, mercurochrome intravenously should be still regarded as experimental medication and used only in extreme cases. When the disease is at a standstill or retrograding under one solution, change to another will frequently result in improvement.

The disease begins most frequently in the rectum and sigmoid and this segment is the last to heal. Instillations through the proctoscope of the solutions named or bismuth in oil come in intimate contact with the mucosa of the terminal bowel. Residual ulcers in the rectum and lower pelvic colon are best treated by topical applications of silver nitrate, 15 per cent, through the sigmoidoscope. Insufflation of a powder consisting of equal parts of calomel and bismuth subcarbonate sometimes promotes healing.

Recurrence in many cases is doubtless due to discontinuance of treatment when symptomatic relief is obtained. In the vast majority of cases, repeated proctosigmoidoscopic examinations are the best guide as to the progress of the case. Topical applications should be continued until all ulcers that can be seen through the sigmoidoscope are healed and irrigations should be continued at lengthened intervals for several weeks after apparent cure.

Transfusion of blood should doubtless be used more frequently to combat anemia and stimulate resistance. In several instances after transfusion in children, Helmholz observed immediate and striking effects in decrease of the number of stools and the amount of blood in them. Transfusion was a life saving measure in three of our cases.

Distant foci of infection, such as the teeth or tonsils, should be removed.

Vaccine Therapy.—In recent years vaccines or foreign proteins have been used extensively either for their specific effect or with the purpose of increasing immunity. These agents are in all probability not specific in chronic ulcerative colitis, but their action is to stimulate the formation of antibodies. Hurst, in England, reported some successful results with polyvalent antidysenteric serum. In Germany injections of milk have been used. Fansler has found that intramuscular injections of casein have markedly shortened the course of the disease and hastened the healing of the ulcers. It is generally recognized that vaccines and serums have little influence on streptococcic infections. Yet, J. A. Bargaen has prepared a vaccine and a vaccine filtrate of the diplococcus made from cultures taken from the bases of the colonic ulcers and from foci infected with the same organism, such as periapical abscesses of the teeth. In ninety-two cases in which this vaccine or filtrate was used without other treatment except eradication of foci of infection, extraction of teeth, tonsillectomy, or cholecystectomy, clinical cure resulted in eighty-five and improvement in the remainder. Of 101 cases in which vaccine or filtrate was administered, together with other medication, clinical cure occurred in sixty-eight and improvement in thirty-three. Remissions lasted from one to three years in 114 of the 153 cases clinically cured, and in fifty-one of them the mucosa appeared to be entirely clear of ulcers through the proctoscope. Symptoms recurred in twenty-

four cases, seventeen of which responded favorably to further treatment. Seven cases which gave disappointing results with medical management were operated upon. Injections of the vaccine or filtrate are given subcutaneously every third day, beginning with 0.1 c.c. and increasing each dose by 0.1 c.c. up to 1 or 1.5 c.c., according to the patient's reaction.

As our bacteriologist was not successful in isolating the diplococcus, Barga very kindly supplied vaccine and vaccine filtrate which we used in seven cases. The results were marked improvement in one case, fair improvement in two and no effect in the others. This may have been due in part to the fact that vaccine and filtrate were stock and not autogenous.

We administered autogenous vaccines made from cultures of the predominating organisms taken directly from the ulcers in fifteen of our cases. The vaccine used was *B. coli communis* in eight cases, *B. coli* and *Staphylococcus albus* in six cases, and hemolytic streptococcus in one case. The response was prompt and favorable in four of these patients who were apparently cured, and five others were markedly improved.

Even if a specific microorganism initiates the disease, we know that when chronic ulceration of the colon is established the usual intestinal flora infect the ulcers secondarily and so maintain the process. Benefit from autogenous vaccines may therefore accrue in some cases by stimulating resistance to the secondary infection. In view of our experience, and that of others, our present feeling is that in all cases resistant to dietetic and local treatment, autogenous vaccines subcutaneously or a foreign protein, as casein, intramuscularly, should receive a trial before resorting to surgery.

Surgical Treatment.—Chronic ulcerative colitis is primarily a medical condition. Foci of infection, such as the teeth, tonsils or gall-bladder, should be eliminated. Surgery on the intestine is justifiable only after competent trial of medical management. Urgent intervention is indicated in a certain few fulminating, septic cases, which are rapidly passing to a fatal issue; when complications such as abscess or peritonitis develop as a result of bowel perforation, and occasionally when the entire colon has practically become a contracted septic tube. If an abscess forms, drainage may prove satisfactory, but a fecal fistula is apt to follow. In the event of perforation, the indications are to close the opening in the bowel and perform an ileostomy. Even when these measures are carried out immediately, the prognosis is grave and the mortality high.

The operative procedures available are appendicostomy, cecostomy, colostomy, ileostomy, ileosigmoidostomy and colectomy. All but the last two can be performed under local anesthesia, which is a boon for these debilitated patients. Sigmoidostomy is of value only in controlling the complication of perirectal suppuration.

Any stoma to be effective either for medication or diversion of the fecal current must be well above the limits of the disease. Hence it must be in the cecum or terminal ileum.

APPENDICOSTOMY AND VALVULAR CECOSTOMY afford a means of irrigating the entire colon, but do not sidetrack the intestinal contents. Nevertheless these procedures have many cures to their credit. Of the two procedures, appendicostomy is preferable. Weir, in 1902, first utilized the appendix for the purpose of irrigating the colon. Only seldom is the appendix rudimentary or its lumen so obliterated that it cannot be used. The abdomen is opened through a very short (2 inch) gridiron incision over the cecum, and the appendix, grasped with two fingers, is drawn through the wound. In the further steps of the operation it is essential not to injure the vessels supplying the appendix (Fig. 212). The cecum adjacent to the base of the appendix is united to the peritoneum and fascia by catgut sutures. No difficulty is experienced in avoiding the cecal branches as fortunately these vessels indicate their position by visible pulsation. In some instances the appendix is so straight and its mesentery is so narrow that the abdominal wound can be closed about it at once. The majority of appendices, however, are falciform, due to the appendix being longer than its mesentery. To render the lumen fairly straight for the catheter it is necessary to free the mesentery. This is accomplished by ligating and cutting the mesentery at

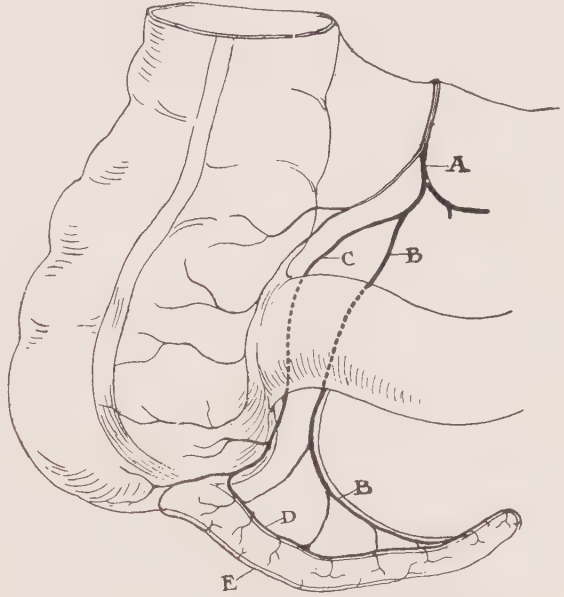


FIG. 212.—ARTERIAL BLOOD SUPPLY OF APPENDIX.
A, posterior ileocecal artery (partly schematic); *B*, appendicular branch; *C*, cecal branch; *D* (constant) and *E* (variable), branches from cecal to appendix.

a point sufficiently distant from the base of the appendix that the blood supply is preserved to that portion of the appendix which traverses the abdominal wall. This method insures a viable organ up to the skin surface, but is open to the objection that the tip may soon become gangrenous and infection of the wound occur. A better method and one which insures an intact viable appendix is to separate the two layers of the mesentery at its free border and carefully displace the cellular tissue with its contained appendicular artery and branches as far as necessary toward the appendix. Further precautions are not to obliterate any arteries by forceps, ligature or suture; tension or torsion in fixing the appendix in a position where it does not rest naturally, or compression by closing the abdominal wound too snugly about it. The wound

is closed in layers and the appendix is attached to the skin by a single suture. After applying vaselin to the protruding appendix, it is covered with a rubber dam and surrounded by a ring of gauze over which the dressings are applied. As a rule it is unnecessary to test at once the patency of the appendix. This step adds an element of danger from infection. However constricted the lumen may be at first, it readily dilates sufficiently to admit a 7 to 10 F. soft rubber catheter, the optimum sizes. Unless treatment is urgent, the appendix is ampu-



FIG. 213.—CHRONIC ULCERATIVE COLITIS.

Radiogram showing non-haustiation of descending colon. Patient, male, aged twenty-six years. Markedly improved by treatment through an appendicostomy.

tated about 1 centimeter from the skin on the seventh day, the teatlike prominence thus left giving easy entrance to the tube. The tube is inserted only for irrigating. Irrigations are carried out with the patient resting on a bed-pan and a tube introduced a short distance into the rectum to prevent pressure.

The operation of appendicostomy is on a par with an interval appendectomy as regards technic, speedy convalescence and safety. If the blood supply of the appendix is carefully preserved, the appendix does not slough, there is little or no leakage of feces and there is no hernia through the clean abdominal wound.



FIG. 214.—APPENDICOSTOMY.

Same as Fig. 213 as it appeared in 1928, twelve years after operation by the author. No leakage.

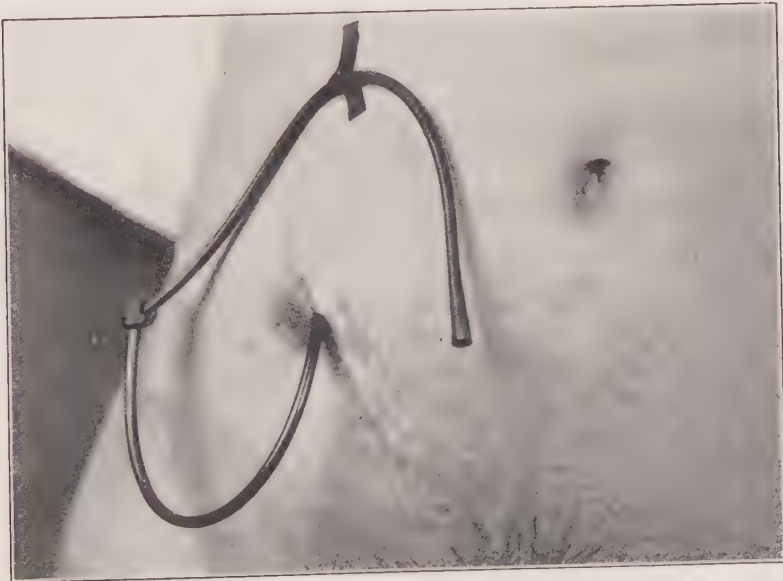


FIG. 215.—APPENDICOSTOMY.

Same patient as Fig. 213 with No. 9 F. catheter *in situ* for irrigating.

It is advisable to leave the appendicostomy open many months or even years after the colitis is apparently cured, as a precaution in case of recurrence. Closure can be effected at any time by applying nitric acid to the mucosa, which causes obliteration of the lumen.

If, because of anatomical or pathological conditions, the appendix cannot be utilized, a valvular cecostomy is performed by the Gibson, or preferably the Witzel method.

ILEOSTOMY.—At this writing, ileostomy by the method of Brown is deservedly the most generally employed operation for chronic ulcerative colitis. It has the important advantage of completely diverting the fecal current, but the disadvantages inherent in a fecal fistula that requires operation for closure.

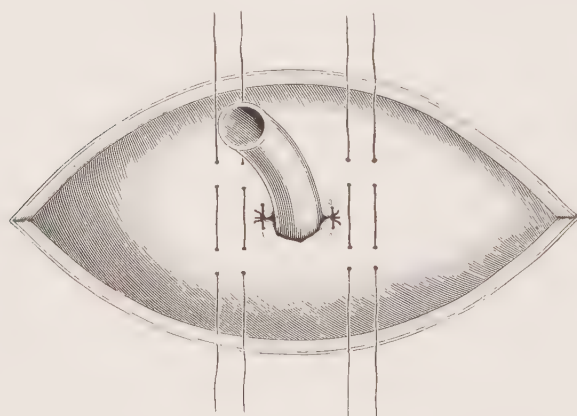


FIG. 216.—FIRST TIER OF SUTURES IN VALVULAR COLOSTOMY.
(Gibson.)

The abdomen is opened through a right rectus or muscle-splitting incision of the McBurney type, and a free loop of ileum, 2 to 4 inches above the ileocecal valve, is brought through the wound. The ileum is divided between clamps, and the peritoneum sewed about its two loops by interrupted sutures of fine catgut. The rest of the wound is then sutured about the protruding intestine.

Rankin suggests insertion of a good-sized rubber tube into the proximal ileum at the time of operation and invaginating it into the bowel with two purse-string sutures. The distal loop is utilized later for irrigation of the colon. The stoma may be closed by lateral or end-to-side anastomosis of ileum to cecum.

Strauss forms a knuckle of the ileum 4 to 6 inches above the ileocecal valve by suturing the limbs of the loop together near their mesenteric attachment, a distance of 2 inches. The peritoneum is sewed all about the two loops at such a point that when the wound is closed the knuckle protrudes $\frac{1}{4}$ inch above the skin. The ileum is cut across in twenty-four to forty-eight hours and irrigations are begun five or six days later. Closure is effected by resecting $\frac{1}{2}$ inch of ileum on each side and then doing an end-to-end anastomosis.

After ileostomy is established, some cases have poor control, but in others fortunately the stools eventually become semisolid and control is further aided somewhat by the abdominal muscles, so that the patient is fairly comfortable.

Further operative procedures after ileostomy are governed by the response of the colon to irrigations and the general condition of the patient. If, two or

three months after stopping all irrigations, the pathologic rectal discharges cease, sigmoidoscopy shows a healed mucosa and the colon appears normal on x-ray examination, the question of restoring continuity of the bowel may be considered. Owing to the marked tendency of the disease to relapse after long periods of apparent cure, a delay of several months before closing the ileostomy is advisable. On the other hand, the non-functioning colon tends to undergo contraction, and too long a delay in closure of the ileostomy may result in a physiologically useless colon.

COLECTOMY.—A persistence or recurrence of symptoms argues for colectomy. However, this hazardous operation is indicated only when the entire colon is involved and all its coats implicated so that it is practically an irregularly contracted suppurating tube, frequently complicated by arthritis and other systemic evidences of septic absorption.

Primary colectomy has a considerable mortality. A graded procedure is less hazardous. Strauss, Friedman and Block reported three cases of colectomy performed some time after ileostomy, with satisfactory results.

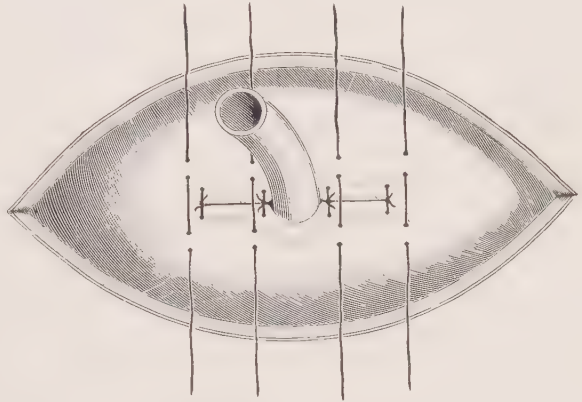


FIG. 217.—LAST TIER OF SUTURES IN GIBSON'S METHOD.

ILEOSIGMOIDOSTOMY. —

Ileosigmoidostomy, which consists in the lateral implantation of the terminal ileum low into the sigmoid flexure, sidetracks the major portion of the colon. This should be combined with ileostomy on the right side or an appendicostomy to assure drainage of the colon.

Serious drawbacks to both colectomy and ileosigmoidostomy are that the anastomosis has to be done with diseased bowel and that the rectum and distal portion of the sigmoid remain. In the majority of cases they are the first segments infected and the last to heal. With the intestinal contents passing through them, the residual ulceration tends to persist indefinitely in this situation despite local treatment. In a case observed by Buie the ileostomy had to be restored eight years after ileosigmoidostomy, ulceration persisting in the terminal bowel until the rectum contracted to a tube 1 centimeter in diameter.

In a similar case, colectomy had been performed on a man, aged thirty-one, three years before he consulted the author. His general condition had improved somewhat, but he was still anemic and 30 pounds under weight, evacuations containing mucopus numbering twenty per day, the rectum and lower sigmoid being ulcerated and contracted to a diameter of 2 centimeters.

Strauss suggests that after colectomy, the distal loop of sigmoid be

brought out through an incision in the left lower quadrant of the abdomen. When the residual sigmoid and rectum have healed, bowel continuity may be reestablished by closing this stoma and performing an ileosigmoidostomy. The statement that the terminal ileum, when implanted into the sigmoid, gradually dilates and assumes colonic function has seldom been borne out in the cases we have observed.

Very few statistics of the results of surgical treatment of chronic ulcerative colitis are available. Tuttle collected seventy-seven cases of appendicostomy, including fourteen of his own; six died, a mortality of 7.8 per cent.

Mummery, who advocates early surgical intervention, contrasts the results of medical and surgical treatment. Of eighty-two collected cases, thirty-three were treated medically; twenty-six died, a mortality of 78 per cent; while of forty-nine operated upon, only nine died, a mortality of 18 per cent. His figures in twenty-two personal cases were nineteen recoveries and three deaths, a mortality of 13.6 per cent.

In 1918, Logan reported an immediate operative mortality of 11.8 at the Mayo Clinic with various types of operation, ranging from appendicostomy to partial colectomy.

Of these cases nineteen showed improvement, in seven to such a degree that the original opening was closed by ileocolostomy. In Bargaen's series of cases, ileostomy was performed in five. One died from multiple pulmonary abscesses, another from diffuse carcinomatosis of the colon. Colostomy was performed on another patient for rectal stricture, but he died later from carcinomatous degeneration of the ulcerated colon.

In considering the results of surgical treatment one should remember that, as a rule, operation is done as a last resort in either the acute fulminating or the depleted chronic cases, that have been rebellious to medical treatment.

In our series of one hundred cases, the results of treatment in eighty, which were observed over a long period of time, are given in the appended table:

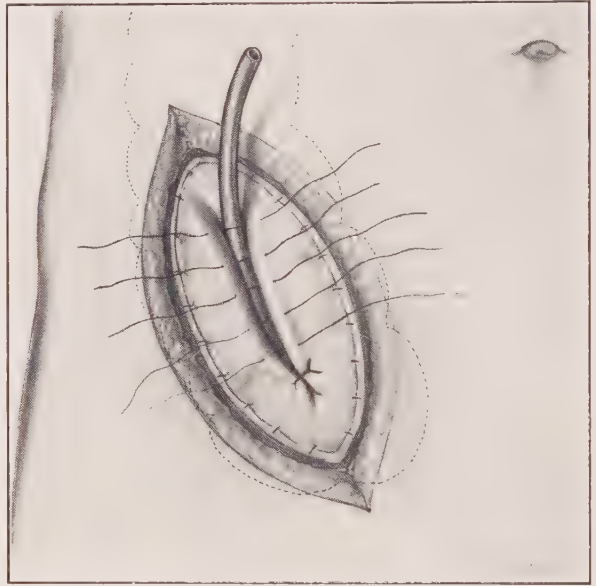


FIG. 218.—CECOSTOMY.

Witzel method of gastrostomy applied to the cecum.

RESULTS OF TREATMENT (AUTHOR'S SERIES)

	No Benefit	Fair Improve- ment	Marked Improve- ment	Clinically Well	Died	Total
Medical						
Local and general	6	5	11	13	1	36
Emetin with local and general	1	1	2		1	5
Autogenous vaccine (B. coli, staphylococcus, hemolytic streptococcus)	3	2	5	4	1	15
Stock diplococcus vaccine and filtrate (Bargen)	4	2	1			7
						63
Surgical						
Blood transfusion	1	1	3			5
Appendicostomy	1*	2	2	3		8
Valvular cecostomy		1				1
Colectomy		1	1		1	3
						17
TOTALS	16	15	25	20	4	80

* This patient died 1½ years after the operation.

REFERENCES

- ALBU, A. *Mitt. a. d. Grenzgeb. d. Med. u. Chir.*, Jena, 1914-1915, 28: 386-414.
 BARGEN, J. A. *J. Am. M. Ass.*, Chicago, 83, 1924, 83: 332-336.
 ——— *Minnesota Medicine*, Nov., 1927.
 ——— *Arch. Surg.*, Chicago, October, 1928.
 BARGEN, J. A., and LOGAN, A. H. *Arch. Int. Med.*, Chicago, Dec., 1925, 36: 818-829.
 BASSLER, A. *Med. J. & Rec.*, July 18, 1923; Feb. 16, 1927.
 BROWN, J. Y. *J. Am. M. Ass.*, Chicago, Aug. 12, 1916, p. 67.
 BUIE, L. A. *J. Am. M. Ass.*, Chicago, Vol. 87, Oct. 16, 1926.
 CROHN, B. B., and ROSENBERG, H. *J. Am. M. Ass.*, Chicago, Vol. 83, Aug. 2, 1924.
 FANSLER, W. A. *Med. J. & Rec.*, Oct. 5, 1927.
 HAWKINS, H. P. *Brit. M. J.*, Lond., 1909, 1: 765-770.
 HELMHOLZ, H. F. N. *York M. J.*, Jan. 15, 1926.
 HURST, A. *Guy's Hosp. Rep.*, Lond., 1921, 61: 26.
 KENDALL, A. I. *Gastro-Intestinal Bacteriology*, Philadelphia, Lea & Febiger, 1916.
 LOGAN, A. H. *Northwest Med.*, Seattle, Jan., 1919, 18: 1-9.
 ——— *Med. Clin., N. America*, July, 1923, 7: 105-112.
 ——— *Illinois M. J.*, Vol. 49, Feb., 1926.
 MCCARRISON, R. *Studies in Deficiency Disease*, London, Frowde, 1921.
 MUMMERY, P. Lockhart. *Diseases of the Rectum and Colon*, New York, Wm. Wood & Co., 1923.
 RANKIN, F. W. *Surgery of the Colon*, New York, D. Appleton & Co., 1925.
 STRAUSS, A. A., FRIEDMAN, J., and BLOCH, L. *Surg. Clin. N. America*, 1924, Vol. 4.
 TUTTLE, J. P. *J. Am. M. Ass.*, Chicago, Aug. 11, 1906.
 WEIR, R. F. *Med. Rec.*, N. Y., 1902, Vol. 62.
 WHITE, H. *Guy's Hosp. Rep.*, Lond., 1888, Vol. 46.
 WILKS and MOXON. *Lectures on Pathological Anatomy*, 2d Ed., 1875, p. 408.
 YEOMANS, F. C. *Proc. Am. Proctol. Soc.*, 1910.
 ——— *J. Am. M. Ass.*, Chicago, Dec. 24, 1921, Vol. 77.

CHAPTER XV

DYSENTERY

Th specific infections producing coloproctitis are caused by protozoa, as amebæ, *Giardia lamblia*; by *Bacillus dysenteriae*, *Bacillus tuberculosis*, *Spirochæta pallida*, gonococcus, *Bacillus diphtheriae* and by *Streptococcus erysipelatis*.

As diphtheria and erysipelas very seldom invade the rectum, they are omitted in this work; and gonorrhea and syphilis will be discussed under Venereal Diseases.

BACILLARY DYSENTERY

This is an infection by the dysentery bacillus, several strains of which have been described. In 1898 the bacillus of Shiga was announced as the only pathogenic agent constantly found in epidemic dysentery of Japan. Flexner, working in Manila, P. I., confirmed these findings, so that one strain bears his name, and another is known as the Mount Desert strain. The many strains of *B. dysenteriae* are classified, largely on the basis of their similar biochemical properties, into three types. Type 1, of which the Shiga organism is the exponent, is found in the most severe epidemics and is probably the important factor in the high mortality. Types 2 and 3 conform biochemically more closely to the colon group. The clinical course of dysentery due to these types is comparatively much milder.

Mortality of infections by Type 1 is stated by Shiga for Japan as 22 plus per cent; by Kruse, for Germany, 10 per cent. Parke, studying infections in New York City and vicinity, found a mortality of 6 per cent. In about one-half of the cases the Shiga type of organism was found in the feces. The disease in these cases ran a severe clinical course with a high mortality.

Formerly bacillary dysentery was considered to be a tropical disease, but now, due to increased travel and especially the movement of troops, it is of frequent occurrence in temperate zones.

The disease may appear in sporadic, endemic or epidemic form. Many cases have been discovered in soldiers returning from campaigns in the tropics. In 1912, Hunt reported that there had been nine epidemics in Pennsylvania since 1905. In 1916 Smillie reported seventy-nine cases occurring in infants in Boston. Smith relates an epidemic occurring in a city of 35,000 in New York State, during the summer of 1916, in which there were 227 cases of intestinal disease, of which forty-nine died.

No age is exempt and the sexes are affected equally. Patients and healthy carriers are sources of infection by use of the same toilet and towels. Contami-

nated food, possibly water and milk, and flies especially carry the infective agent.

Pathology.—Generally the inflammatory process is superficial and confined to the sigmoid flexure and rectum, although the entire colon may be involved. In more severe cases there may be a hemorrhagic exudation into the submucosa with subsequent accumulation of leukocytes, resulting in tissue necrosis and ulceration. The ulcers are of irregular form and bleed readily.

The disease is usually acute, but may be chronic and occur in carriers without symptoms. The chronic cases are comparatively much less frequent than non-specific ulcerative colitis or chronic amebic infection, from which they are to be differentiated.

Acute bacillary dysentery, the usual type encountered, has a period of incubation of three to seven days. It is characterized by a sudden onset, temperature (102° F.), griping pains, becoming tenesmus when the lower rectum is involved; nausea, loss of weight and strength, and frequent stools. The dejecta at first contain considerable mucus, later admixed with fresh blood, gradually changing to mucopurulent, due to exudation of polymorphonuclear leukocytes and desquamated epithelium, and finally becomes fecaloid as the inflammatory process subsides.

Ordinarily an acute attack ends in about one week in children and in a fortnight or longer in adults, although some cases may become chronic. There is a recurrence in a few cases.

In tropical countries, the disease may assume the choleraic type. Fever, vomiting and frequent large watery stools (thirty plus daily) produce rapid dehydration and early collapse of the patient. This may lead to a fatal termination in a few hours, or quick recovery may take place in a few days. The severe constitutional symptoms are due to toxemia.

The leukocyte count of the blood is usually normal, but may reach 15,000, due almost wholly to increase of the polymorphonuclears.

Palpation shows tenderness over the involved portion of the colon, which may be spastic. Whenever possible, sigmoidoscopy should be done to inspect the lesions and to obtain material for cultures directly from the diseased mucosa.

Bacteriological examination may isolate the *B. dysenteriae* from the stools during the early days of the disease, but is rarely successful after the second week. It is essential to make cultures immediately from fresh material, otherwise overgrowth of other bacteria may obscure the specific organism.

Because of the difficulty of obtaining positive cultures, the more certain agglutination tests are employed in making the diagnosis, especially in the chronic cases. From about the sixth to the tenth day and thereafter, specific agglutinins are present. Blood-serum of the patient is tested against standard agglutination groups of the various types of dysentery bacilli, namely, the non-acid Shiga type and the acid types of Flexner, Hiss, Mount Desert, etc. A serum dilution of 1:50 is considered positive for Shiga, while 1:100 is positive for the acid groups.

Treatment.—In the *acute* cases, the *diet* in the early stages is restricted to barley water, egg albumin, whey, broths and expressed juice of beef. The diet is gradually increased as the general condition improves. If milk is used, it should be boiled, diluted with an equal amount of barley water, and rendered alkaline by adding 5 grains of sodium bicarbonate and 1 ounce of lime water to each pint. If undigested milk-curd is passed in the stools, the milk should be peptonized or discontinued. One dram of magnesium sulphate is given three times a day for the first few days, and diminished as the stools lessen in frequency and improve in appearance. Opium in sufficient quantity to control the diarrhea and tenesmus may be necessary. Irrigations of the colon with normal saline solution are recommended.

Specific treatment consists in the administration of multivalent antidyenteric serum. The dosage and manner of giving the serum varies with the case. An initial dose of 40 to 100 c.c. is given subcutaneously in the flank or intravenously. One large dose may be sufficient to cure some cases. For others, two or three additional subcutaneous doses of 40 to 60 c.c. of serum are required at intervals of forty-eight hours.

In *chronic* bacillary dysentery polyvalent serum is generally not effective, although occasionally it is of great benefit. Vaccines are indicated to increase the patient's resistance, even if they will not effect a cure. An autogenous or stock vaccine of the same type isolated from the stool or proved by agglutination is used. It is given subcutaneously until a reaction is obtained. Then Nolf gave one-thousandth of the last dose by vein, increasing every fourth day in rapidly increasing doses. He obtained much better results by the intravenous method.

AMEBIC DYSENTERY

The scientific study of amebic dysentery dates from 1875 when Lösch reported the discovery of amebæ in the stools of a patient with dysentery at St. Petersburg, Russia.

Amebiasis is one of the most widespread and dangerous of tropical diseases. Yet the term "tropical dysentery" formerly applied to it, is at present a misnomer. Since methods of its accurate diagnosis have been applied, the geographical distribution of amebiasis has been found to embrace not only all tropical countries, but the subtropical and temperate zones as well. In 1904, Tuttle reported eighteen cases, none of the patients having been below the thirty-seventh degree of latitude. Sanford, reporting on the examination of approximately five thousand patients at the Mayo Clinic from 1911-1916, found *Entamoeba histolytica* in the stools of 535 patients from northern states. According to Kaplan, during the year 1926, thirty-five cases of amebic dysentery were treated at the Cook County Hospital, Chicago, and seven cases originating in a large hotel were traced to an Assyrian cook employed there.

Occurrence.—The disease is endemic, epidemic and sporadic. In the tropics particularly it is endemic. According to Cook, of the Civil Hospital in Manila,

30 per cent of all their patients have amebic infection; fifty of every thousand natives contract the disease annually, and five of these die. Europeans are especially prone to infection. Kofoed and his coworkers; Boeck and Stiles, and others, as a result of their researches, estimate that about 10 per cent of the population of the United States is infected with *Entamæba histolytica*. Naturally the incidence is greater along the southern border.

In the temperate zones, sporadic cases are most common, although small epidemics are not unusual. In one such, occurring in New York City, fifteen Armenians were infected, the source being a fruit and vegetable dealer.

During the past twenty-five years we have personally observed approximately 125 cases. The majority of these were soldiers and travelers returning from the tropics, but several patients had scarcely ever been outside of Greater New York. Amebic patients from the tropics had, as a rule, received treatment, with transient improvement or a recurrence.

Etiology.—Low-lying, damp, swampy countries, where malaria flourishes, favor amebic infection.

Sex has no special influence, except that males are more exposed, and so are more frequently infected.

Age.—No age period is exempt, but the majority of cases occur between the ages of twenty to forty. It is very rare after sixty and exceptional in infants. The incidence increases from infancy onward. Boiled water and exclusion of green vegetables from the diet protects young babies from infection.

De Buys observed eight cases in infants and children, ranging from twenty-three months to twelve years of age. Four of these were among 313 cases of amebic dysentery at the Charity Hospital, and four at the Touro Infirmary, New Orleans. With suitable treatment the prognosis in children is good.

The specific cause of amebic dysentery is infection by the *Entamæba histolytica* which is usually ingested with water or green vegetables and fruit grown in a soil which harbors the ameba. The natives of tropical countries not only drink the water of pools, but bathe in them and use ditches as latrines, thus polluting the soil and the water. Another dangerous source of infection and of some small epidemics is chronic carriers in the capacity of cooks, food handlers and vegetable dealers.

During 1893-1895, S. Kartulis demonstrated in the Greek and Arab Hospitals at Cairo the presence of entamebæ in every one of 150 consecutive autopsies on victims of dysentery, while they were absent in those dying from other causes.

In 1903, Schaudinn showed that there may be parasites in the colon of man, and two zoölogical species of these vary widely in their morphology, life cycles and modes of reproduction. One of these he termed *Entamæba coli* and showed it to be harmless; the other he named *Entamæba histolytica*, and found it to be pathogenic and the definite cause of amebic dysentery.

Viereck, in 1907, described a four-nucleated cyst which he termed *Entamæba tetragena*, as characteristic of a pathogenic ameba.

Amebæ are single-celled, minute animal organisms of nucleated protoplasm. At least five different species of amebæ may be found in the human intestine, namely, the pathogenic *Entamæba histolytica* (*Amæba dysenteria*, Schaudinn, 1903); the practically harmless *Entamæba coli*, the innocuous and less commonly present *Entamæba nana*, *Iodamæba bütschlii* and *Entamæba hartmanii*.

Entamæba histolytica is a protozoa of the class Rhizopoda and genus Entameba. Two stages in the life cycle of *Entamæba histolytica* can be distinguished: The *vegetative* or motile stage; and the *cystic* or resting stage. An intermediate or precystic stage precedes cyst formation, but these *minutia* or smaller forms can seldom be distinguished from the precystic stage of other species of amebæ parasitic in man. In the active vegetative stage the *Entamæba histolytica* is an obligatory tissue parasite. When viewed under the microscope at rest, it is generally oval or spherical in *shape*, varying from 20 to 35 microns in diameter, but when the pseudopodia are extruded it may reach a diameter of 75 microns. The size is fairly uniform in the same individual. Motility is very active in freshly passed stools, but soon subsides with cooling.

There can be distinguished in the cytoplasm a clear, hyaline outer portion, the ectoplasm, and a granular inner portion, the endoplasm, which contains a spherical hyaline nucleus, usually invisible without staining, unless the stools have been passed for some time. The nucleus is placed eccentrically and contains a nucleolus. Motility is effected by the ectoplasm thrusting out finger- or flask-shaped pseudopodia into which the endoplasm flows. Ingestion of erythrocytes in amebæ present in intestinal contents is a characteristic and diagnostic feature. They may be in such numbers as to give the ameba a reddish or greenish tint. Inclusions of bacteria and vacuoles are notably absent unless degeneration is occurring. Amebæ multiply by binary fission and sporulation. The active vegetative forms are found only in the liquid stools, while acute dysenteric symptoms are present, and the cystic forms in the formed stools after the acute symptoms of dysentery have subsided. Amebic dysentery is transmitted almost entirely, if not exclusively, by the resistant cysts. Transmission is direct without the

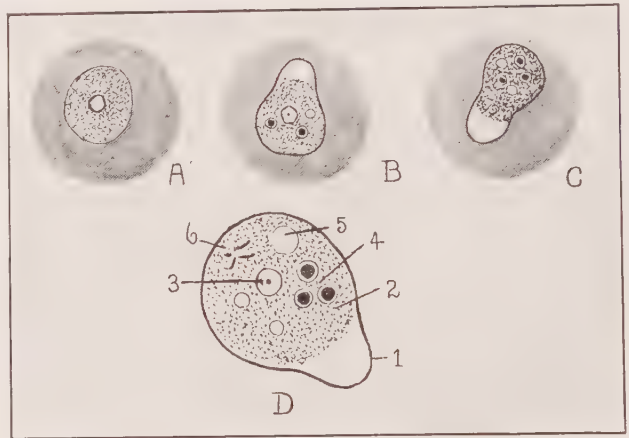


FIG. 219.—PARASITIC AMEBÆ.

A, *Entamæba coli*; B, C, *Entamæba dysenteria*; D (diagrammatic), (1) ectoplasm; (2) endoplasm; (3) nucleus, nuclear membrane, centriole; (4) erythrocytes; (5) vacuole (adapted from Craig). (Morris, *Clinical Laboratory Diagnosis*, New York, D. Appleton & Co., 1923.)

intervention of an intermediary host. Discovery of the cysts is most important for the diagnosis of "carriers" as well as for prophylaxis and treatment. Entamebic cysts appear as oval or round bodies, 7 to 15 microns in diameter. There is no differentiation of ectoplasm from endoplasm. The cytoplasm is free from foreign substances and vacuoles. Cysts of the various species of amebæ may be differentiated after staining with iodine solution. The fully developed histolytica cyst contains four round nuclei of the same character as those of the vegetative form. The mature cyst of *Amœba coli*, the most common ameba occurring in man, contains eight nuclei. The ripe cyst of *Entamœba nana* contains from one to four smaller nuclei of oval shape.

Pathology.—As a rule, the anatomical changes are limited to the large bowel. Only exceptionally does the disease extend above the ileocecal valve into the ileum. The sites of involvement, in order of frequency, are approximately: Cecum, 80 per cent; ascending colon, 70 per cent; rectum, 50 per cent; sigmoid, 40 per cent; appendix, 33 per cent; hepatic flexure, 4 per cent; splenic flexure, 0.5 per cent. The transverse colon usually escapes. This estimate is based largely on autopsy material. As the proximal colon in them was involved almost twice as often as the sigmoid and rectum, proctoscopy would not rule out amebiasis in these cases. In our experience proctosigmoidoscopy almost always revealed lesions of the mucosa. The ameba invades the intestinal wall by its pseudopodia of relatively stiff ectoplasm, penetrating between the epithelium, as Schaudinn observed on fresh sections of a cat's mucosa infected with *Entamœba histolytica*. As a rule invasion is not through the surface of the mucosa. In a histologic study of necropsy material from chronic cases, Kenneth M. Lynch found an accumulation of four to eight amebæ at the bottom of the crypts. The epithelium at this point was partially or wholly destroyed, while that lining the neck of the gland was partially or wholly intact. From the base of the crypt the amebæ migrate into the submucosa over a considerable radius. A low-grade inflammatory reaction follows accumulation of amebæ beneath the mucosa, with edema, infiltration of leukocytes, some proliferation of the fixed tissues, and thrombosis of the blood-vessels of the mucosa, resulting in necrosis and the formation of a superficial ulcer. By gaining entrance to the lymphatics and capillaries, amebæ may be distributed through the circulation to all parts of the body. The muscle tunic of the intestine seems to resist the progress of the amebæ. The ulcers, however, may penetrate to or perforate the serosa, resulting in local or general peritonitis, or the formation of adhesions to adjacent organs.

Viewed through the proctoscope, active amebic infection in its early stages presents a characteristic appearance that is diagnostic. The mucosa is closely set with discrete ulcers in various stages of development, the intervening mucosa being comparatively normal. The most characteristic feature is millet-seed-sized elevations with a pearl gray center and reddish periphery. After this necrotic surface has sloughed, round or oval ulcers appear with rather firm elevated borders, which are undermined. In fulminating cases with extensive undermin-

ing, large sloughs of mucosa may be cast off, leaving broad areas of denudation. After cure is effected in acute cases the mucosa may appear normal or show only scattered pale areas of superficial scarring. In chronic cases the sites of ulceration are marked by oval pits or clefts with firm base and margins, the result of connective-tissue repair. After the typical amebic ulcers have become secondarily infected by the normal intestinal flora, their characteristic appearance is lost. Definite thickening of the bowel wall with constriction of its lumen is a very rare occurrence.

Symptoms.—The period of incubation varies from three to six weeks. The clinical manifestations are of a protean character, ranging from the “latent” cases with few or no dysenteric symptoms to the “fulminant,” which may end fatally in a few days.

Acute Amebic Dysentery.—Periods of diarrhea may precede the acute attack, which usually comes on suddenly and is characterized by frequent passages, as many as fifteen or twenty in twenty-four hours. The small fluid stools, containing blood-tinged mucus and degenerated epithelium, are accompanied by griping and tenesmus. Thirst and anorexia are complained of and the patient becomes apathetic and weak. The temperature may be slightly elevated or depressed below the normal. Pressure over the sigmoid area usually elicits tenderness. With treatment the acute attack may be cured in ten days to a fortnight, but in the majority of instances the infection becomes chronic.

In the tropics especially the acute attack may take a *fulminating* course. Gangrenous sloughs may be evacuated, indicating extensive ulceration of the bowel. Toxemia, vomiting and the frequent stools rapidly lead to exhaustion and collapse, ending fatally in five to ten days.

Chronic Amebic Dysentery.—Chronic cases, which are frequently sporadic in the temperate zones, may be sequelæ of the acute cases or be chronic from the beginning. Following the acute attack the stools become formed and are of normal appearance or contain only a little blood and mucus, in which amebæ or cysts may be found. The patient may feel perfectly well, but generally has some disturbances of digestion and lassitude. Then, after a varying period of weeks or months, and frequently without any evident cause, there is a relapse of the dysenteric attack. Complete recovery does not take place, but the disease runs a chronic course of months or years, marked by alternate periods of remission and relapse. Pressure over the course of the colon frequently shows definite areas of tenderness and thickening. Proctosigmoidoscopy during an exacerbation in this class of cases usually reveals typical amebic ulcers.

Some patients with chronic infection become anemic and emaciated; develop nervous symptoms, such as tremor, insomnia and palpitation, and finally die from exhaustion.

Other patients, comprising the “latent” group, live for many years as “carriers,” exhibiting few or only indefinite symptoms. The latter include general debility, a feeling of abdominal unrest, intestinal indigestion and occasionally attacks of transitory diarrhea, occurring usually at night. The large evacuations

are commonly free of blood and mucus. Although these patients possess a relative constitutional immunity to infection, they may fall victims to a severe attack of the disease.

Complications.—The most frequent and most serious complication of amebic dysentery is abscess of the liver, the so-called tropical liver abscess. In autopsied cases, abscess of the liver varied from 11 per cent (Krause and Pasquale); 23 per cent (Musgrave); 33 per cent (Craig); to 51 per cent (W. J. James, Herrick Clinic, Panama). The abscess is solitary in 50 to 75 per cent of cases and is usually situated in the right lobe near its upper surface. In 708 instances collected by Rouis, the abscess was in the right lobe in 70.8 per cent of cases, and in the left lobe in 13.3 per cent. Exceptionally multiple abscesses are present. In our experience hepatic abscess is a rare complication of amebic dysentery in northern latitudes. We have seen only four instances of it, all males, in 125 cases personally observed. In the majority of cases the abscess occurs during the first month after infection. Its incidence may bear no relation to the acute attacks and the abscess may develop long after all dysenteric symptoms have subsided. The most common mode of hepatic infection is through the portal vein. Amebæ may be demonstrated in the contents of the abscess, but especially in scrapings from its walls. Bacteria are also usually present—streptococci, staphylococci and *Bacillus coli*. By extension through the diaphragm, hepatic abscess may rupture into the lung, less often into the stomach or colon, or break through the skin surface. Embolic abscess of the brain occurred in 3 per cent of Kartulis' cases of abscess of the liver, the amebæ being carried by the blood stream. Kartulis observed six cases of abscess of the liver associated with entamebic appendicitis, which a high eosinophilia sometimes serves to distinguish from an ordinary appendicitis.

The chief symptoms are discomfort or pain in the right hypochondrium, indigestion, profuse perspiration and a daily temperature ranging from normal or subnormal in the morning to 102° F. in the evening. In protracted cases the patient becomes anemic, emaciated and weak, and the skin sallow.

Examination usually shows a domelike enlargement upward, corresponding to the right lobe of the liver, frequently a general enlargement of the liver below the free costal margin, and local tenderness on pressure. The greatest aid in the diagnosis is a history of dysenteric attacks coupled with discovery of motile ameba or their cysts in the stools. Aspiration of the abscess is sometimes permissible. Demonstration of amebæ in the aspirated fluid is conclusive for the diagnosis. Leukocytosis may be absent in old abscesses, but in others the leukocytes usually vary from 12,000 to 25,000, with a relative increase in polymorphonuclears to 70 or 80 per cent of the total.

Diagnosis.—The diagnosis of entamebic dysentery is made on a history of an attack of dysentery while in the tropics; proctosigmoidoscopy which frequently reveals typical amebic ulcers or ulcerative lesions of the mucosa, and by discovery of motile amebæ or amebic cysts in the stools. Demonstration of the organisms by the microscope is the only positively diagnostic criterion. Previous

administration of bismuth, barium, calomel, milk or castor oil interferes with recognition of the amebæ. The feces are passed in a clean vessel free of antiseptics, which still motile amebæ and alter their morphology. The same changes occur when the stool is allowed to remain long at room temperature. For this reason, stools should be examined preferably at once after collection, or at least within two hours. In acute cases a flake of blood-tinged mucus is placed on a slide and a cover-slip applied. The mucus may contain many motile amebæ, while relatively few are present in other portions of the stool. In chronic cases and those having formed movements, administration of 1 ounce of magnesium sulphate before examination produces liquid stools in which there is a much better chance of finding motile amebæ. Sometimes a rectal tube with a lateral eye, after insertion into the rectum, is rotated to obtain material.

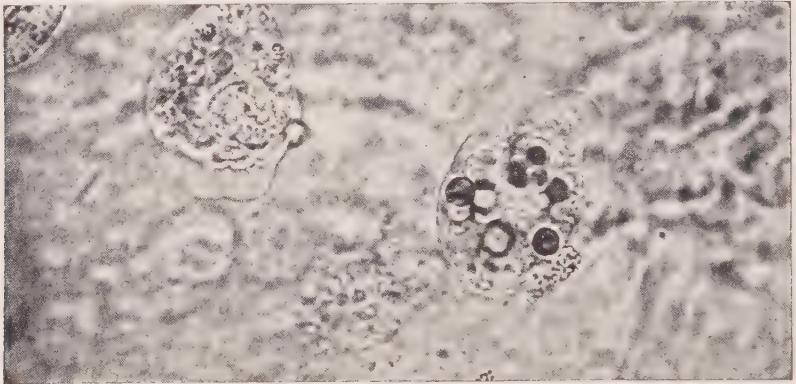


FIG. 220.—*ENTAMOEBA HISTOLYTICA*.

Motile forms showing ingested red cells and clear ectoplasm (Army Medical School Collection, Washington, D. C.) (Zinsser, *Textbook of Bacteriology*, New York, D. Appleton & Co., 1927.)

The method practiced by the writer for many years is superior to all others for obtaining material from the rectum and sigmoid. After passing the sigmoidoscope, material is taken directly from the ulcers on a 12-inch applicator wrapped tightly with cotton for smear and culture.

Paulson and Andrews have confirmed the advantage of the sigmoidoscopic method over examination of the defecated stool in 210 patients, in each of whom both methods were employed, for the detection and incidence of human intestinal protozoa. The specimens were examined microscopically and for flagellates by culture. In those who had not ingested barium sulphate within six days of the sigmoidoscopic examination, the incidence of all organisms in defecated specimens was 13.7 per cent, as compared with 46.3 per cent from sigmoid contents. The group that had taken barium sulphate within six days of examination showed a total incidence of 8.7 per cent defecated specimens, compared with 20.9 per cent from sigmoidoscopic specimens.

When examining a formed stool one should mix with the specimen on the

slide a drop of warm normal saline solution. The inexperienced will have considerable difficulty in differentiating *Entamæba histolytica* from other species parasitic in man. With increased experience their recognition and differentiation is usually a simple matter, but requires patient search and frequently the examination must be repeated. In the examination of the stools on successive days, Brown found that in five hundred cases of amebiasis, a single examination of the stool detected the organisms in approximately 70 per cent; that two examinations on successive days raised the percentage to 90, and three examinations to 98.

At first a rapid survey of the preparation is made with the low power of the microscope, and preferably on a warm stage. A nest of isolated amebæ thus discovered is then examined more closely and in detail under the higher magnification of the oil immersion lens to assist in identification. The *Entamæba histolytica* presents for its identification the characteristic appearance already described. These features are brilliantly enhanced by the addition of a drop of eosin (1:1,000 aqueous solution) to the specimen. Subacute and chronic cases that do not show motile *Entamæba histolytica* in the feces are *histolytica*-cyst carriers. To enable us to study their cytology and count the number of nuclei in the encysted forms, the specimen before examination is mixed with Dobell's iodine solution. This consists of a 5 per cent aqueous solution of potassium iodide saturated with iodine, which is diluted with equal parts of distilled water just before using. Staining with this solution does not always differentiate the *histolytica*-cysts from those of other amebæ. However, we can count the four nuclei in the cyst which is a characteristic feature of the mature *histolytica*-cyst and is in marked contrast to the *coli*-cyst which, when ripe, contains six or eight nuclei.

Culture of Entamæba Histolytica.—Boeck and Drbohlav have discovered a successful method of cultivation of *Entamæba histolytica* from the stools. This is of great practical value in the diagnosis of doubtful cases, the detection of carriers and in the control of treatment, in that cultures are positive in many cases in which smears are negative. St. John took cultures of stools from sixty-one apparently healthy men, and recovered amebæ of the *histolytica* type in six, an incidence of 9.8 per cent. In five of the six instances direct smear preparations were negative at previous examinations.

Differential Diagnosis.—Entamebic is to be distinguished chiefly from bacillary dysentery. The latter is usually more acute in onset and course, fever is nearly always present, the stools contain more pus, cultures of the stools show the *Bacillus dysenteriae* and the blood-serum, agglutination. It must be remembered that amebic and bacillary dysentery may coexist in the same patient.

Microscopic examination for amebæ reveals at the same time other parasites and their ova. The protozoa infesting the intestines are classified on the basis of their mode of locomotion as: (1) Rhizopodia, typical of ameba, with locomotion dependent upon the pseudopodia; (2) Mastigophora, the flagellate, by

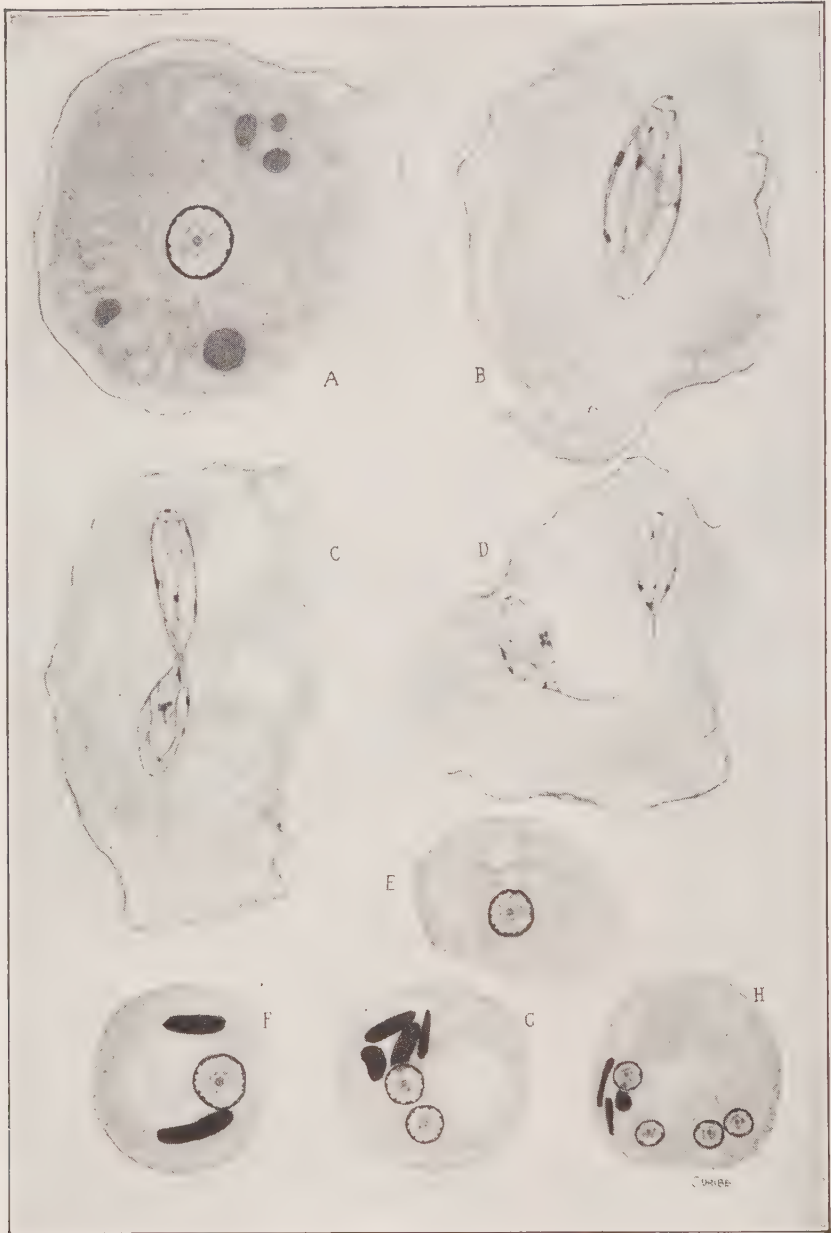


FIG. 221.—*ENTAMOEBA HISTOLYTICA*.

A, large trophozoite containing red blood-corpuscles.

B, an early stage of nuclear division showing a loose achromatic reticulum with chromatin granules irregularly distributed, and the centriole apparent at the upper pole at the apex of a broad, clear cone, sharply demarcated from the reticular portion, the centriole at the lower pole not shown in profile.

C, a later stage in nuclear division showing constriction and characteristic torsion in the formation of the daughter nuclei; the centriole is shown at the upper pole only.

D, daughter nuclei after the rupture of the connecting filament, the centrioles apparent in both.

E, a precystic ameba devoid of all cytoplasmic inclusions.

F, *G*, *H*, uninucleate, binucleate and quadrinucleate cysts, each showing the chromatin bodies with rounded ends and glycogen "vacuole" in *F* and *G*.

A-D, from eosin-methylene-blue stained sections of intestine of infected cat. *E-H*, from films of human stool stained with Heidenhain's iron hematoxylin. (Drawings by Uribe, Zinsser, *Textbook of Bacteriology*, New York, D. Appleton & Co., 1927.)

a whipping movement of its filamentous protrusions; (3) Sporozoa, in the motile stage, by a vermicular movement of the entire body; and (4) Ciliophora, producing motion by its cilia.

In each class there are a number of species. Five species of flagellate are known, the three most frequently found being *Giardia intestinalis* (also called *Cercomonas* or *Lamblia*), *Chilomastrix mesnili* and *Trichomonas intestinalis*.

Opposing views are held as to the pathogenicity of the flagellates. Some investigators assert that a large percentage of persons harbor them and that they are harmless, while other observers consider them pathogenic. Their habitat is the bowel lumen and, as a rule, they cause no demonstrable lesions of the mucosa, although the *Giardia* may possibly produce ulceration. All of them, especially when in massive infestation, irritate ulcers of the intestine caused by other agents. No form of treatment has proved successful for their permanent eradication.

Balantidium coli is the species of ciliophora found most frequently in the large bowel, especially the cecum of man. It is a specific parasitic organism, measuring 50 to 70 microns in breadth, which invades the tissues deeply and causes ulcerative colitis. It is a natural parasite of the pig; man is its accidental host. It is seen most commonly in Finland, Russia and Sweden, but sporadic cases have been reported elsewhere.

Prognosis.—With the discovery of new and specific agents for the treatment of amebic dysentery, the prognosis is much better than formerly. Strong treated two hundred private patients in all stages of infection, with twelve deaths and chronic invalidism in four. The acute attacks are promptly checked by treatment, but the disease is prone to relapse or become chronic, frequently with secondary infection of the ulcers. Complications of liver or other abscesses, bacillary infection, renal disease or pneumonia render the prognosis grave in chronic cases. In children the prognosis is good, Ambrey and Musgrave losing only two of forty-four cases.

Treatment.—If the symptoms are acute or the patient's general condition is poor, rest in bed is enjoined. Subacute and chronic patients are not so confined except as may be necessary for certain forms of treatment.

The diet should consist of simple, digestible foods with little residue. The objective of the treatment is to eliminate entirely the vegetative forms and cysts of *Entamæba histolytica*.

Colonic irrigations were formerly much used. While they allayed the acute symptoms, they failed to eliminate the cysts, and as a rule relapse occurred. Favorite solutions were normal saline, quinin sulphate, 1:5,000 to 1:500; silver nitrate, 1:5,000, and kerosene, 1 to 2 quarts (Hanes). Of these, quinin either alone or combined with thymol 1:1,000 has been most extensively used and given the best results. Brem and Zeiler reported as "well" twenty-five of thirty-four cases treated with quinin and thymol combined in the same solution. One or two quarts are given as an enema once or twice daily, and the patient is encouraged to retain the solution ten or fifteen minutes.

Bismuth Treatment.—Deeks and Shaw, of Ancon Hospital, used "heroic" doses of bismuth subnitrate, the beneficial effects of which they attributed to its germicidal properties and sedative and astringent action on the mucosa. Brem and Zeiler's mortality in 123 cases treated by irrigation was 17 per cent, while in 129 cases of Deeks and Shaw treated by the bismuth method, it was 18 per cent.

Ipecac Treatment.—In 1658 Piso brought ipecac root from Brazil to Europe. Helvetius used it with such success in the treatment of Louis XIV that it gained great popularity in dysentery. Its vogue waned, however, until Surgeon E. S. Docker, by using massive doses, reduced the former death rate at Mauritius of 10 to 18 per cent, to 2 per cent. Since then physicians have recognized the merit of ipecac, when well borne, in the treatment of certain forms of dysentery, but the impossibility of administering therapeutic doses without distressing nausea and vomiting limited its use. In later years, largely through the teaching of Sir Patrick Manson, massive doses of ipecac have been quite extensively used again.

In 1909 both Dock and Simon contributed papers on the subject. A course of treatment ordinarily covers ten days, during which the patient is kept in bed. The diet consists of broth, whey, albumin water and nutrient alcoholic preparations. Milk may sometimes be added on the fifth or sixth day of treatment. First day: 8 A.M., castor oil, 1 ounce. Nothing by mouth after 6 P.M. At 9 P.M., ten to fifteen *freshly made* pills, each containing 5 grains of powdered ipecac root and coated with salol $\frac{1}{10}$ inch thick, are swallowed slowly with moderate amounts of water. The patient rests on his right side and no nourishment is given for at least six hours after the pills are taken. Ten to fifteen pills are administered every night until one hundred in all are *retained*. A record is kept of undissolved pills recovered.

Brem and Zeiler reported on twenty-one cases of intestinal amebiasis *with dysentery* treated by this method. There were no deaths nor complications, but five relapsed, four of whom were not thoroughly treated. In one of the failures, a cure was obtained by administering through an appendicostomy on seven successive days 45 to 75 grains of powdered ipecac suspended in starch water. The author obtained a successful result in two cases by administering the starch water suspension of ipecac through a duodenal tube. Distressing gastric symptoms preclude the use of ipecac in many patients, even when administered in keratin or salol coated pills, and with opium, tannic acid or chloral to control vomiting.

Emetin.—The modern treatment of entamebic infection on a scientific basis dates from the work of Vedder. He found that emetin in dilutions of 1:100,000 killed entamebæ *in vitro*, i.e., was twice as amebicidal as the fluidextract of ipecac. Consequently he believed it probable that the power of any given specimen of ipecac to kill amebæ is in direct ratio to its emetin content. He also stated that "emetin acted on amebæ deep in the tissues after absorption in the blood stream," and while being eliminated, in part, through the intestinal mucosa.

According to the *United States Dispensatory*, the active alkaloids of ipecac are emetin, the emetic constituent, an amorphous powder discovered by Pelletier in 1867; cephaëlin, which is crystalline; and a glucosid, ipecacuanhic acid. The Brazilian root contains approximately 1.5 per cent of emetin, hence 1 grain of emetin is equivalent to about 60 grains of powdered Brazilian ipecac root. Major Leonard Rogers of Calcutta made clinical application of Vedder's findings. In 1912, Rogers reported twenty-four consecutive cases of entamebic dysentery treated by emetin subcutaneously, of which twenty were "cured." A few amebic abscesses of the liver and one of the spleen were cleared up by aspiration of the abscess and injection into the cavity of one or more grains of emetin dissolved in 1 ounce of saline solution.

Following the brilliant reports of Rogers, other workers in all parts of the world have published their results, which as a whole are very favorable.

In 1913, Baermann and Heinemann, of Sumatra, as a result of their experience in twenty-two selected cases, observed that the organisms usually disappear from the stools in from six to seventy-two hours after beginning the emetin treatment, but often reappear four to seventy days later. They also noted toxic symptoms of large dosage. In a few instances, they gave the drug intravenously after preliminary experiments on animals, by which they concluded that from 200 to 250 milligrams is the maximum intravenous dose for a body weight of 60 kilos.

Emetin is used in the form of its soluble salt, emetin hydrochlorid, which is supplied in tablets or in ampules containing the salt in a sterile solution. Toxic doses of emetin produce general depression with failure of respiration, due to direct action on the center; and cardiac failure due to direct action on the heart and vasomotor center. Because of the cardiovascular effects there is a profound fall of blood-pressure. The central nervous system is depressed and neuritis may occur.

However, when used with intelligence and in the proper dosage, emetin causes no harmful systemic or by-effects. The average dose is $\frac{1}{2}$ to 1 grain of emetin hydrochlorid, dissolved in 10 to 15 minims of normal saline solution, and injected subcutaneously over the deltoid muscle. This dose is administered daily for one week. Treatment is suspended one week and then the course is repeated. A third course may be given, if indicated, depending upon the return of stools to the normal in number and appearance, the absence of amebæ, and the healing of the ulcers as shown by the proctoscope. Prolonged administration may produce systemic effects and in its elimination through the mucosa cause bowel irritation. Moreover, long-continued use of therapeutic doses are unnecessary, as the active entamebæ will be destroyed by two or at most three courses of emetin and further injections have no effect on the encysted forms, if present. A total of 20 grains of emetin in the course of a month is the maximal safe dosage.

Intravenous administration of emetin has a much greater toxic action on the central nervous system and the heart than when given hypodermically.

The intravenous dose is ½ grain dissolved in 100 c.c. normal saline solution, which is injected very slowly. The vein method is seldom, if ever, indicated in the type of amebiasis seen in northern latitudes.

Emetin Bismuthous Iodid.—In 1915, Du Mez of Manilla, P. I., devised emetin bismuthous iodid, the formula of which is:

	<i>Per Cent</i>
Iodin	58.26
Bismuth	12.36
Hydrogen (as hydrogen iodid)....	0.30
Emetin	29.08

This salt is insoluble in dilute acid, but soluble in weak alkali. In its passage through the bowel it is gradually decomposed with liberation of emetin and precipitation of bismuth sulphid. It seems probable that the entameba cysts do not live freely in the intestinal contents, but that they are localized in partly healed pockets and sinuses of the mucosa, more or less isolated from the circulation and tissue fluids. This hypothesis explains the failure of emetin to eliminate the cysts in many cases, and argues for the superiority of ipecac or emetin bismuthous iodid which, given by mouth, come in intimate contact with the mucosa. In 1916, Dale reported on the use of emetin bismuthous iodid in ten cases, all of which showed cysts passing after courses of hypodermic emetin. Seven of these were cured, one relapsed, and nausea prevented two from taking full treatment. Later Dobell gave the comparative results of cases treated with emetin and emetin bismuthous iodid, several of the latter having had courses of hypodermic emetin.

	Treated with Emetin Hydrochlorid	Treated with Emetin Bismuthous Iodid
"Certain" cures	5	9
Uncertain cures	2	8
Relapses	17	0
TOTAL CASES	24	17

Emrie, Law and others were successful in eliminating the cysts in carriers with emetin bismuth iodid. The drug is given in gelatin capsules of 1 grain, three of which are swallowed after the evening meal or three hours later, on twelve successive nights. A course consists of 30 to 36 grains which is equivalent to 10 to 12 grains of emetin hydrochlorid. Giddiness, depression, diarrhea or vomiting may interrupt the course. Vomiting occurring several hours after ingestion of the drug may be due to absorption of the liberated emetin from the bowel.

Yatren.—In 1921, Muehlens and Menk devised yatren for the treatment of amebiasis. Chemically it is iodine-oxy-quinoline-sulphate plus sodium bicarbonate to increase its solubility, and contains about 28 per cent of iodine. Its solubility

in water is about 4 per cent. It is claimed that yatren is non-toxic, still some patients have bowel irritation when it is used.

In acute cases, the adult dose is two tablets of 0.5 gram three times daily for ten days. The entamebæ disappear from the stools in two or three days, but it is advised that after an interval of a fortnight the 3 grams of the drug be given daily for a period of five days. In severe chronic cases, it is recommended that the oral administration of yatren be supplemented with rectal injections of a 1 to 1.5 per cent solution of the drug. After a colonic irrigation, 200 to 300 c.c. of the solution at body-temperature is injected and retained as long as possible. An injection is given on six to eight nights in succession, and the course repeated after an interval of three to six days.

The Arsenicals.—Several organic arsenical compounds have been used in the treatment of amebiasis, namely, the trivalent arsphenamin and neo-arsphenamin, and, more recently, the French preparations tréparsol (Flandin, 1924), acetylarsan (Garin and Lépine, 1924) and stovarsol (Marchoux, 1923), now designated acetarsone by the Council on Pharmacy and Chemistry in *New and Non-Official Remedies*. The pentavalent tréparsol and stovarsol seem to be less toxic than the trivalent compounds. Stovarsol is the arsenical preparation that has been used most extensively and with great satisfaction in amebiasis. In 1922, Levaditi and his coworkers devised this synthetic arsenical at the Pasteur Institute, Paris, and in 1923-1924 Marchoux reported on its amebicidal properties. Stovarsol is the acetyl derivative of 3-amino 4-oxyphenyl 1-arsenic acid, and according to the formula, contains 27.28 per cent arsenic. It is stable at ordinary temperatures, only slightly soluble in water, but readily soluble in solutions of alkali hydroxids.

Johns and Jamison obtained complete relief of all dysenteric symptoms in forty-six patients within three to six days after beginning the oral administration of stovarsol. Of these patients, twenty-seven were kept under observation, and repeated clinical, proctoscopic and stool examinations were made to determine the permanency of relief. It was found that twenty-one patients remained well and free from infection, an average of 3.8 months; five relapsed after remaining well 3.9 months, and one patient, who received eight courses, relapsed a few days after the completion of each course.

Brown used stovarsol alone in sixty-one cases of amebiasis. The stools in all were negative for parasites after one course of the drug. In five of the cases examined from six to eight months after stopping all treatment, the stools were still negative. In twenty-two cases observed proctoscopically, the entamebic ulcers were practically healed in from eight to ten days after beginning treatment. Not all of the sixty-one cases were followed up, but six recurrences were known to have occurred, in five of which ulcerative amebic proctitis was present. Of seventeen cases of amebic ulcerative proctitis, five (23 per cent) recurred, whereas there were ten (53 per cent) recurrences in nineteen cases treated with hypodermic emetin.

The usual dose of stovarsol is a tablet of 0.25 gram ingested with the food

three times a day for six or seven days. If a second course of stovarsol is indicated, it should follow at an interval of ten days to ensure elimination of all the arsenic and prevent cumulative toxic effects. Both clinically and by animal experimentation, stovarsol is relatively non-toxic. A mild toxic erythema has been noted in a few cases, and in others mild digestive disturbances, such as flatulence and nausea, but no vomiting or diarrhea. These are usually avoided by not giving the drug longer than six or seven days in succession, although Marchoux, who records only two failures in fifty-nine cases of amebiasis, recommends the continuous administration of the drug over a period of four weeks.

It is a common observation that when cure is not effected by one or two courses of any drug, continuation of the same treatment will usually not eliminate the infection. This seems to be due to the entamebæ becoming emetin-fast or arsenic-fast, as the case may be. In this event, change to another amebicidal drug is indicated, and frequently with the most happy results.

After a period of months or years latent encysted amebæ may reappear in an active vegetative form, accompanied by all the symptoms of an acute attack. Hence, entamebic patients should be kept under prolonged observation. Naturally, when the entamebæ have invaded the tissues deeply and are widely disseminated, "cure" may be permanent or clinical only.

Because of the extensive destruction of the mucosa in the ulcerative cases and the secondary infection of the ulcers by the normal intestinal flora, mucus, pus and blood in diminishing quantities may continue to be discharged for some time after the stools are negative for entamebæ and cysts. In these cases, rectal irrigations and topical applications through the proctoscope will materially hasten the process of tissue repair. Some cases, however, will merge into the class of chronic non-specific ulcerative colitis.

The majority of cases of entamebic abscess of the liver will require treatment on the principle of open incision and drainage.

REFERENCES

BACILLARY DYSENTERY

- BASTEDO, W. A. *Blumer's Bedside Diagnosis*, Philadelphia, W. B. Saunders Co., 1928, Vol. I.
 HUNT, C. J. *J. Am. M. Ass.*, 1912, 54:12.
 SHIGA. *Centralbl. f. Bakteriöl. u. Parasitenk.*, Jena, Nos. 22 and 24, 1898.
 SMILLIE, W. G. *Am. J. Dis. Child.*, Chicago, Vol. 13, April, 1917.
 SMITH, JOHN A. *N. York State J. M.*, Sept., 1917, 17:9.

AMEBIC DYSENTERY

- BAERMANN and HEINEMANN. *München. med. Wchnschr.*, Vol. 21, May 27, 1913.
 BOECK, W. C., and DRBOHLAV, J. *Proc. Nat. Acad. Sc.*, Balt., Vol. 2, No. 5, May, 1925.
 BOECK, W. C., and STILES, C. W. *Treas. Dep. Pub. Health & Mar-Hosp. Serv., U. S. Hyg. Lab. Bull.*, 133, 1923.

- BREM, W. V., and ZEILER, A. H. *Am. J. M. Sc.*, Phila., Nov., 1910.
——— *New Orl. M. & S. J.*, July, 1911.
BROWN, P. W. *J. Am. M. Ass.*, Chicago, Feb. 13, 1926.
CRAIG, C. F. *A Manual of the Parasitic Protozoa of Man*, Philadelphia, 1926.
——— *J. Am. M. Ass.*, Chicago, Jan. 1, 1927.
——— *Blumer's Bedside Diagnosis*, Philadelphia, W. B. Saunders Co., 1928, Vol. I.
DALE, H. H. *Lancet*, London, July 29, 1916.
DE BUYS, L. R. *J. Am. M. Ass.*, 1914, 63: 21.
DEEKS, W. E., and SHAW. *Med. Rec.*, N. Y., Oct. 13, 1909.
DOBELL, C. *Brit. M. J.*, Lond., 1916, 2: 612.
DOCK, G. *N. York M. J.*, July 10, 1909.
DU MEZ. *Philippine J. Sc.*, Manila, 1915, Sec. B, Vol. 10.
JOHNS, F. M., and JAMISON, S. C. *J. Am. M. Ass.*, June 20, 1925.
KAPLAN, B., WILLIAMSON, C. S., and GEIGER, J. C. *J. Am. M. Ass.*, 1927, 88: 13.
KOFOID, C. A., and SWEZY, O. *Am. J. Trop. Med.*, Jan., 1921.
LEVEDITI, C., ET AL. *Ann. de l'Inst. Pasteur*, Par., Vol. 36, Nov., 1922.
LÖSCH, F. *Virchow's Arch. f. path. Anat.*, Berl., 1875, Vol. 65.
LYNCH, Kenneth M. *J. Am. M. Ass.*, 1920, 75: 1.
MARCHOUX, E. *Paris méd.*, Vol. 14, Nov. 22, 1924.
MENK, W. *München. med. Wchnschr.*, 1922, Vol. 69.
PAULSON, M., and ANDREWS, J. M. *J. Am. M. Ass.*, 1927, 88: 24.
ROGERS, Leonard. *Brit. M. J.*, Lond., June 22, 1912.
——— *Therap. Gaz.*, Detroit, Dec. 15, 1912.
ST. JOHN, J. H. *J. Am. M. Ass.*, 1926, 86: 1272.
SANFORD, A. H. *J. Am. M. Ass.*, 1916, 67: 26.
SCHAUDINN, F. *Arb. a. d. k. Gsndtsamte.*, Berl., 1903, Vol. 29.
TUTTLE, J. P. *J. Am. M. Ass.*, Oct. 8, 1904.
VEDDER, E. V. *Bull. Manila Med. Soc.*, March, 1911.
YEOMANS, F. C. *N. York M. J.*, Feb. 14, 1914.

CHAPTER XVI

ULCERATION

PERIANAL ULCERATION

Ulcerations at the anal verge and of the perianal skin are found most frequently in persons who are careless in matters of hygiene and local cleanliness. They are due to trauma followed by infection, irritating discharges from the bowel and vagina, gonorrhea, chancroid, chancre, syphilis, herpes, eczema, ringworm, tuberculosis and carcinoma (epithelioma, rodent ulcer).

The majority of these causes are discussed under their respective headings in this work; traumatic ulceration will be taken up later, and the others will be considered here.

A variety of skin diseases may involve the perineum, but the only common ones resulting in ulceration are ringworm and herpes.

Ringworm.—Infection of the perianal skin by the fungus of ringworm must be of rare occurrence. However, the frequent incidence of this dermatophytosis, warns us to consider the possibility of ringworm in the differential diagnosis of those cases of pruritus ani in which the skin is abraded and ulcerated. Scrapings from the margin of the patch are placed on a glass slide, a drop of 10 per cent sodium hydroxid added, and the cover-slip applied. Examination of the preparation under the microscope usually reveals the fungus, if present.

Herpetic Ulceration.—Herpes, either of the simple or zoster variety, occurring in the anal region is comparatively rare and is not usually considered as coming within the sphere of the proctologist. However, the proctologist may be the first to be consulted, and it is important that he recognize the true nature of the condition which may not be so simple in the later stages. In its initial stage, anal herpes, as in other regions, is characterized by a vesicle or group of vesicles following more or less the course of a cutaneous nerve. These are accompanied by a sense of burning or smarting, sometimes actual pain, and may be confounded with eczema or pruritus. In the later stages, following rupture of the vesicles, secondary ulceration may develop in the perianal skin and be mistaken for chancroids or even true chancre.

In the vesicular stage the treatment consists in puncturing the vesicles and applying a soothing lotion or a drying powder such as aristol or formidin. Should actual ulceration ensue, it should be treated along the lines recommended under simple ulceration. Relapses are fairly common, and attention should be directed to any underlying constitutional affection, particularly of the nervous system. The application of ultraviolet or heat rays may hasten drying of the vesicles.

Eczema of the anus may appear in the erythematous form, the skin about the anus and between the buttocks being red and moist, and giving rise to itching, burning and a watery discharge. It is commonly observed in stout persons, is often associated with lesions of the same type on the scrotum and other cutaneous areas.

Discharges from the rectum and vagina may irritate and infect the perianal skin, producing an eczemoid appearance, but ulceration seldom ensues.

Rodent ulcer, which occurs late in life, is now generally recognized as a slowly growing epithelioma having an ulcerated surface.

ULCERATIONS OF THE ANUS, RECTUM AND SIGMOID

Excluding cancer, the vast majority of the ulcerative processes encountered in the anal region, rectum and sigmoid are bacterial or protozoal in origin, and are usually classified as specific and non-specific. The former are initiated at least by a definite and specific etiological factor and they include the tuberculous, venereal, dysenteric, amebic, diphtheritic and carcinomatous. These have been discussed in the chapters devoted to these diseases.

The non-specific or simple variety embraces a large number of ulcerative conditions which, in the majority of cases, are infectious processes engrafted on a traumatic base or are associated with pathological conditions which predispose to bacterial infection by the heterogeneous flora of the intestinal tract. Their nomenclature is, therefore, somewhat loose. They are commonly divided into the following:

1. Traumatic
2. Follicular
3. Stricture
4. Stercoral
5. Varicose
6. Hemorrhoidal

In addition to the specific and non-specific types, there remains a group of unusual ulcerations occasionally encountered in the course of constitutional or organic diseases, particularly in their terminal stages. These include:

1. Nephritic
2. Diabetic
3. Trophic
4. Hepatic
5. Marasmic
6. Typhoidal

Finally, ulcerations of the rectum and colon may be produced by drugs ingested or injected per anum, of which mercury (bichlorid), ether (colonic anesthesia) and arsenic are the most common.

The above classification and terminology serve as a convenient working basis. Obviously it is unsatisfactory, but with reason, since clinically and bacteriologically it is frequently quite impossible to distinguish the exact type of ulceration present because the initial process is quickly supplemented and modified by secondary infection. Moreover, the earlier ulcerative changes, causing but few symptoms, are very apt to be overlooked. It is not unlikely that many simple ulcers, occurring in the intestinal tract, heal spontaneously.

Combined types of ulcers may, furthermore, occur in the same bowel, and tuberculous, luetic or carcinomatous processes may be engrafted on simple ulcers.

Traumatic Ulceration.—In the perianal skin traumatic ulceration is of little clinical significance and the process encountered here differs from cutaneous ulcerations elsewhere only in the matter of more difficulty in cleanliness and reinfection. Seepage from the rectum actually plays the more important rôle in their spread and persistence than the original trauma. They are usually single but may be multiple. As a rule they remain superficial, with irregular margins and a granular sluggish base covered with a grayish exudate. They occasion but few symptoms, but pruritus is at times annoying.

The treatment consists essentially in cleanliness, particularly after stool. Peroxid of hydrogen in 10 to 20 per cent strength, or permanganate of potash solution, 1 : 10,000, are useful cleansing lotions. For sluggish ulcers, scarlet red ointment 3 per cent, tincture of iodine, or silver nitrate, 5 to 10 per cent, stimulate granulation and epithelialization.

Ulceration of the anal canal may originate in its lining membrane, or it may become involved secondarily through extension of perianal lesions or lesions of the rectum proper.

Traumatic ulcers of the anal canal result from infection engrafted on lacerations or fissures of the anal mucosa following the passage or introduction of foreign bodies, violent divulsion, operative procedures, as hemorrhoidectomy, the Whitehead operation, plastic repair of the sphincters, rectocele, prolapse and the injection of hemorrhoids. The majority of lacerations in the anal canal heal quite promptly with proper care, but poor drainage and constant reinfection may lead to ulcers of fairly large dimensions.

Clinically anal ulcers resemble fissure of the anus, but they seldom give rise to the severe pain characteristic of true fissures. The latter are usually single and situated either in the posterior (85 per cent) or anterior commissure, while traumatic and specific ulcers are frequently found latterly, are at times multiple, and may extend up into the rectum or out upon the perianal skin.

The *symptoms*, particularly pain, depend in great measure on the involvement of the sphincters; the deeper the ulcer the greater is the reflex irritation. Discharge of pus, sometimes with blood, varies in amount. Sphincter spasm, difficulty and fear of evacuation and occasionally backache and dysuria may be present.

The *treatment*, considering the size of the lesion, is often unsatisfactory and protracted owing to the constant reinfection and motion of the parts. Complete

rest may be necessary and sphincter spasm, if severe, should be relieved by dilating or incising the muscle if necessary. The evacuations should be kept soft. The local treatment consists of topical applications of methylene-blue 10 per cent, silver nitrate 10 per cent, mercurochrome 1 to 2 per cent, and tincture of iodine. Daily irrigations of the rectum promote cleanliness and healing. As a rule, suppositories and ointments are of little value. In obstinate cases excision of the ulcer with subsequent suture may prove successful.

In rare instances stricture of the anal canal has followed ulceration.

The great majority of the *traumatic ulcers of the rectum* proper result from unskillful or rough instrumentation with the proctoscope, dilators, bougies, and syringe tips. The rectum may be traumatized by foreign bodies or during attempts at their removal, and an operative wound of the rectum, particularly in persons of lowered resistance, may become infected and ulcerated. A not uncommon cause of traumatic ulceration of the rectum is too vigorous manipulation in massage of the prostate.

The rectal mucosa is peculiarly susceptible to irritation by radium. Excessive doses of this agent may produce early or late ulceration of a very distressing and chronic character.

Traumatic ulcerations are more apt to be found on the anterior than on other portions of the rectal wall and, as in the anal canal, represent small abrasions which have become infected. Although usually confined to the mucosa or submucosa, they may penetrate the deeper layers and lead to perforation, abscess and fistula.

The appearance of rectal ulcers is quite variable, depending on the depth and extent of the original injury or wound. As a rule they are superficial with slightly raised edges, irregular in outline and covered with a thick grayish secretion on a granular base. If palpable, they are felt as irregular velvety depressions in the mucosa surrounded by a slightly elevated border which is not particularly hard or indurated.

Traumatic ulceration of the sigmoid is comparatively rare and may follow any of the injuries enumerated above. Impalement injuries may be an unusual cause.

Owing to their location well above the sphincters, rectal and sigmoidal ulcers do not give rise to the painful symptoms common to lesions in the anal canal. In ulcers high up in the rectum, the chief discomfort is a sense of weight and aching in the sacral region. Because of the absence of actual pain and slight discharge, they are also apt to be disregarded at first and, becoming chronic, respond less readily to treatment. In fact a marked sluggishness and chronicity, in spite of treatment, at times characterize these ulcers. This probably depends in part on a lowered resistance of the individual.

Treatment of this type of ulceration is essentially as previously outlined under anal ulceration. Irrigations are supplemented by topical applications made through the proctoscope. In addition, the insufflation of powders on the surface of the ulcers may prove of value. Of these aristol, iodoform and anesthesin are

recommended. A suppository containing ichthyol, 5 grains, should be inserted at night. An efficacious instillation is 1 ounce of olive oil with $\frac{1}{2}$ dram of bismuth subnitrate and 10 grains of iodoform.

Follicular Ulceration.—This type of ulceration represents the initial phase of non-specific chronic ulcerative colitis, in which the ulcerative process is finally very diffuse and extensive, involving at times the entire colon and rectum. (See chapter on Chronic Ulcerative Colitis.)

The type referred to here, however, is the occasional solitary ulcer resulting from infection, infiltration and subsequent sloughing of the center of the solitary follicle. Multiple ulcers of this type may occur in any segment of the large bowel, but their most frequent site is the descending colon, sigmoid and rectum. As a rule, the discrete ulcers with sharply defined margins, are not much larger than a millet seed, but adjacent ulcers may coalesce to form larger and more irregular ones. The condition has been observed in the summer diarrhea of children and is usually associated with some other inflammatory affection of the mucosa.

On account of their size and position above the anal ring, follicular ulcers occasion but few symptoms and no doubt frequently heal spontaneously and unobserved. Pain is practically never complained of. There may be occasional mild colic, tenesmus or a sense of fullness in the pelvis. The bowels are usually regular and the feces may present nothing abnormal. Digital examination of the rectum is negative and proctoscopy is essential to an accurate diagnosis.

The *treatment* is practically as outlined under traumatic ulcers of the rectum and sigmoid. Associated catarrhal conditions or constitutional disease may require appropriate treatment.

Strictural Ulceration.—Stricture of the rectum or sigmoid is almost invariably accompanied by ulceration which results either from retention of purulent material above the constricted area, or from traumatism inflicted by forcing fecal masses through it. Tuttle pointed out that ulceration in stricture may be a local manifestation of lues, tuberculosis or cancer. The ulcerative process usually begins above the stricture and may spread downward through its lumen or upward to varying distances, depending in large measure on the length and size of the stricture and the interference with drainage. Although, as a rule, the process remains superficial, infiltration of the perirectal tissues may lead to abscess in the pelvirectal or ischiorectal spaces, which frequently burrows externally through the perianal skin, forming a fistula. Multiple perianal fistulae frequently complicate inflammatory stricture of the rectum. The interference with the blood supply of the rectal wall, resulting from the extensive fibrosis found in the majority of strictures, is undoubtedly an important predisposing factor to ulceration.

The symptoms and treatment have been described in the chapter on Stricture.

Stercoral Ulceration.—Pressure necrosis of the mucosa by accumulations of hardened or impacted feces, scybala or enteroliths may result in ulcerations which are commonly referred to as stercoral or distention ulcers. They are, as

a matter of fact, largely traumatic and are usually associated with obstipation or constipation of long standing, stricture or obstructions which interfere with the progress of the fecal current and promote excessive peristaltic action of the gut. They are probably quite frequently overlooked, since their most common situation is the sigmoid or colon, often beyond the reach of the sigmoidoscope. They are somewhat more frequent in the aged whose colonic function is apt to be sluggish.

Although usually single, they may be multiple, and clinically their morbid picture is not unlike a traumatic ulcer. Their symptoms are meager if unassociated with stricture or other organic obstructive lesions. Colic, distention or a sense of uneasiness in the pelvis are apt to be attributed to colitis or constipation. Pericolitis, adhesions, obstruction, abscess or peritonitis may be sequels to these ulcerations. Charbonnel has attributed the occurrence of these ulcers in part to circulatory disturbance in the wall of the colon. Cases of perforation with abscess, which were the initial symptoms, have been reported by Berry and Rolleston. In rare instances they may give rise to hemorrhage, the source of which remains obscure if the ulcer is beyond reach of the sigmoidoscope. Mummery collected nineteen cases of this type, in all but one of which the ulcer had perforated, resulting in a usually fatal peritonitis. All but two were men between twenty-seven and sixty-seven years of age. The situation of the ulcers was: Sigmoid flexure, seven; ascending colon or hepatic flexure, four; descending colon or splenic flexure, five; transverse colon, one; cecum, two. Only one ulcer or two near each other, were observed in any case. In thirteen of the nineteen cases the rest of the colon was healthy. The first definite symptom in several of the cases was the sudden onset of peritonitis.

Varicose Ulceration.—This type of ulceration should not be confounded with hemorrhoidal ulceration since a distinction is of importance in the treatment, although true hemorrhoids may, of course, coexist. The condition is doubtless due to varicosities of the superior hemorrhoidal veins, in the lower rectal mucous membrane, resulting in a nutritional imbalance which predisposes it to infection and ulceration. The pathological sequence and chronicity are not unlike a varicose ulcer of the leg, in which venous vascular stasis is the important etiological factor. Constipation, portal congestion, cardiac disease, arteriosclerosis and tumors of the pelvis, all of which tend to cause congestion of the rectal venous supply, are predisposing factors.

The usual exciting cause is an injury or wound of the rectal mucosa, thrombosis or rupture of one of the varicosities, infection of which results in ulceration. In the case of a man, aged sixty, examined by the writer, rupture of a varicose rectal vein was followed by profuse hemorrhage, but healing occurred without infection or ulceration.

The majority of cases have been observed in individuals between thirty and fifty, but Gibbs reported several examples below the age of twenty.

Clinically the ulcers are usually situated on the posterior rectal wall, well above the sphincters. They appear as sharply outlined, irregular depressions with

slightly elevated margin and a red granular base. Ordinarily superficial, these ulcerations are sometimes extensive, even perforating the bowel. A network of dilated veins, surrounding the ulcer and over the rectum, become prominent on having the patient strain. As in ulcer of the lower extremity they tend to be extremely chronic, but usually remain localized and superficial.

The *treatment* should be directed toward relieving the venous congestion, by appropriate measures for any underlying condition. Promotion of healing by topical applications as recommended in traumatic ulcerations, cleansing rectal irrigations, and the avoidance of further trauma by hard fecal masses, should be enjoined. Rest in bed to relieve congestion, massage as a substitute for active exercise, and a diet that does not overtax the portal circulation are essential measures in the treatment of obstinate cases.

Hemorrhoidal Ulceration.—This is a fairly common type of ulceration resulting from thrombosis, necrosis and subsequent sloughing of well-defined internal hemorrhoids, leaving an ulcerated area either at the base or near the summit of the pile. The necrosis usually follows prolonged strangulation, unskillful efforts at reduction, or it may result from the traumatism of hard fecal masses, the application of ice to reduce congestion, cauterizing agents to the surface of the piles, or injection into them of phenol or other substances. The latter may rarely result in a spreading suppurative phlebitis, leading to extensive sloughing of the perianal tissues. Thrombosis of the abdominal veins, abscess of the liver and pyemia with a fatal issue may occur when hemorrhoids are injected carelessly and by the inexperienced. Mummery has reported a case of this kind following strangulation of hemorrhoids in which the entire rectum became gangrenous, resulting in hemorrhage and septicemia.

The clinical picture presents signs of local inflammation; a hard, nodular hemorrhoidal swelling; and an ulceration, varying in size with the amount of thrombosis and slough, in the form of a fissure or a teatlike stump.

The mucosa covering internal hemorrhoids which have been subject to frequent trauma may become eroded or ulcerated, resulting in so-called ulcerated hemorrhoids. Such ulcerations, however, usually remain superficial and are not accompanied by necrosis and sloughing.

In contrast to varicose, hemorrhoidal ulceration tends to heal spontaneously.

As the lesions are situated within the grasp of the sphincters, the symptoms are usually acute. Pain, throbbing, tenesmus and sphincter spasm, with bleeding and a discharge of pus, are the chief manifestations.

Sitz-baths, anesthetic ointments and other palliative measures are unsatisfactory in this condition. Prompt surgical intervention is indicated. Under general or sacral anesthesia the sphincter should be dilated and the hemorrhoids removed, preferably by the clamp-and-cautery method, the heat of which exerts a bactericidal action. The results of surgery in these cases are excellent, but confinement to bed and the period for complete healing are somewhat longer than after an ordinary hemorrhoidectomy.

Ulceration in Constitutional and Infectious Diseases.—Inflammatory and ulcerative lesions of the rectum and sigmoid have been described as complicating nearly every constitutional or infectious disease. Such lesions, however, are comparatively rare; are more apt to be diagnosticated at autopsy than during life, and are, therefore, of little clinical interest to the proctologist. Their pathology and symptoms are similar to the ulcerative processes already described and only those will be discussed which are occasionally encountered. These include the nephritic, diabetic, trophic, hepatic and marasmic types.

Nephritic Ulceration.—This type of ulceration is more commonly met with in the terminal or uremic stages of nephritis and represents a toxic inflammatory invasion of the mucosa, followed shortly by definite ulceration. The process is usually extensive and its onset marked by a tendency to diarrheal passages of a seromucoid character which is the result of an extensive exudation from the inflamed mucosa. This is usually rapidly followed by a superficial ulceration; the passages become more frequent and contain for the most part seropus and blood, together with shreds of degenerated or sloughing tissue. Separation of a slough of mucosa may result in an ulcer reaching the muscularis. Dickinson encountered twenty-two instances of ulcer from renal disease. There were eleven in the small intestine, six in the colon, and five involved in both structures, but none were found in the rectum. In the sigmoid two occurred, one perforating with abscess formation. No doubt these changes in the mucosa are due to the same toxic products which induce the uremia, and they are of grave prognostic import.

Treatment is usually of little avail and should be directed mainly to the kidney condition. Irrigations with 0.5 bicarbonate of soda solution or plain water, followed by instillation of 2 to 4 ounces of aqueous fluidextract of krameria are recommended.

Diabetic Ulceration.—Since the introduction and extensive use of insulin in the severer types of diabetes, ulcerations in the rectum and sigmoid accompanying it are even a greater rarity than formerly. Diabetics are notoriously constipated and it is not unlikely that the ulcerative processes of the rectum and sigmoid occurring in them are largely the result of trauma to the mucosa by hardened feces and straining. Ulcerative processes may likewise be engrafted on catarrhal inflammatory lesions induced by cathartics.

Certainly no definite etiological relationship has been established between the ulceration and the glycosuria. No doubt the rectal and sigmoidal mucosa share in the general vulnerability to infection to which the diabetic is particularly subject.

Diarrhea, on the other hand, is uncommon in diabetics, but, when present, it may be accompanied by a serous discharge mixed with pus and blood. The ulcerative processes occurring with diarrhea are usually of a serious nature and mark the onset of coma. The blood sugar should, of course, be determined.

The healing of the ulcers depends almost entirely on the therapeutic response of the primary disease.

Hepatic Ulceration.—Ulcerative lesions engrafted on internal hemorrhoids which originate in portal congestion secondary to a cirrhosis of the liver, are referred to as hepatic ulcerations. The infection and ulceration are superimposed upon a rupture of one of the smaller veins on the surface of the hemorrhoid. This type of ulceration is commonly referred to as ulcerating internal hemorrhoids. It differs, however, from hemorrhoidal ulceration in that it does not involve the base of the hemorrhoid nor does it result in loss of substance to the pile proper. This distinction may appear somewhat academic, but clinically and therapeutically it is of some importance. In true hemorrhoidal ulceration the treatment is surgical as a rule, while in hepatic ulceration operative measures are apt to increase the portal congestion, aggravating the hepatic disease, and favor anasarca.

Mild hemorrhage from the piles is a beneficial compensatory effort and, if not excessive, should not be interfered with. It seems wise, therefore, when the hemorrhoids are due to hepatic congestion, to treat them palliatively with saline cathartics and ointments, and measures directed to the cirrhosis. Prolapse of the hemorrhoids may be benefited by gentle dilatation of the sphincters.

Trophic Ulceration.—Ulcerative lesions of the rectum, sigmoid and colon are rarely associated with diseases of the central nervous system: Tabes, myelitis, poliomyelitis and tumors, particularly those involving the lumbar segments of the cord. Their etiology supposedly depends upon a lack of trophic innervation to the affected mucosa which, largely through an interference with its vascular supply, becomes predisposed to traumatic and infectious processes, similar to trophic ulcerations in the toes. This relationship, however, is clinically not readily established, unless there be an accompanying relaxation of the sphincters and sensory disturbances in the anal canal.

Trophic ulcers are prone to be of an extremely indolent nature and their healing depends in great measure on the gravity of the nervous disorder which itself is frequently irresponsive to therapy.

Locally the ulcerations may be treated by topical applications as outlined under traumatic ulcerations.

Marasmic Ulceration.—This type of ulceration is peculiar to infants and younger children who are much debilitated and suffer from enterocolitis, the so-called summer diarrhea, and malnutrition, a clinical picture not fully understood and referred to as marasmus. Such infants are frequently tuberculous or luetic and possibly the ulcerative processes found in the lower bowel are dependent in many of them on these diseases. Marasmus is fortunately much less common than formerly. The marked progress in infant feeding, the cleaner handling and better supply of milk and the inclusion of vitamins in the dietary have distinctly lessened the incidence of diarrheal diseases in infants.

Clinically the ulceration is fairly extensive. The mucosa is superficially ulcerated and covered with a grayish exudate. The liquid stools contain blood, admixed with pus and mucus, and undigested food. Partial or complete prolapse of the rectum is an occasional complication.

The disease is progressive and frequently fatal. Locally the ulcerations may be benefited by irrigations, but the chief reliance is in dietetic and constitutional treatment.

Typhoid Ulceration.—In comparison with the small bowel, typhoid ulceration of the colon and rectum is rare. Several instances of perforation of typhoid ulcer of the large intestine have been reported as occurring in the sixth to eighth weeks of the disease. Fitz collected 167 cases of typhoid perforation, twenty of which were in the colon. Cockle, Hadden and others have reported instances of this type of perforation in the pelvic colon. In Murchison's patient, a perforation in the upper rectum opened into a pelvic abscess containing 10 ounces of pus.

Symptoms.—The leading symptoms of ulcer of the rectum and sigmoid in general are a pathologic discharge and pain.

The site and character of the ulcer, rather than its size, determine the symptoms. The discharge, consisting of mucus, pus and blood in varying proportions and quantities, is passed with or independent of the stools. Pain is characteristic of lesions in the anal canal, but when the ulcer is situated at higher levels, colic or a dull ache over the sacrum is the usual manifestation.

Diagnosis.—When the symptoms noted are present, a local examination is indicated. With careful proctoscopy and sigmoidoscopy, there is no excuse for not recognizing ulcers of the rectum and lower segment of the pelvic colon, and in many instances determining their character.

Roentgenologic examination is indicated when a pathologic discharge is present and inspection through the tube reveals no ulceration.

REFERENCES

- BERRY, James. *Tr. Clin. Soc.*, Lond., 1894, 45:84.
 CHARBONNEL. *Gaz. hebd. d. sc. méd. de Bordeaux*, Oct. 10, 1920.
 DICKINSON, W. H. *Tr. Med.-Chir.*, 1894, Vol. 127.
 FITZ, R. H. *Tr. Ass. Am. Physicians*, 1891, Vol. 6.
 GANT, S. G. *Diseases of the Rectum, Anus and Colon*, Philadelphia, W. B. Saunders Co., 1923.
 GIBBS, J. B. *N. York M. J.*, 1892, 56:93.
 MUMMERY, P. Lockhart. *Diseases of the Rectum and Colon*, New York, Wm. Wood & Co., 1923.
 PENNINGTON, J. R. *Rectum, Anus and Pelvic Colon*. Philadelphia, P. Blakiston & Son Co., 1923.
 ROLLESTON, H. D. *Lancet*, London, April 1, 1905, p. 854.
 TUTTLE, James P. *Diseases of the Anus, Rectum and Pelvic Colon*, New York, D. Appleton & Co., 1906.

CHAPTER XVII

TUBERCULOSIS OF THE ANUS, RECTUM AND PELVIC COLON

Tuberculosis is a variety of granuloma, due to infection by the tubercle bacillus discovered by Koch in 1882. It appears in several clinical forms and will be considered as it occurs in the perianal region, the anal canal, the rectum and the pelvic colon.

PERIANAL TUBERCULOSIS

Perianal tuberculosis presents lesions of a miliary, ulcerative, lupoid and verrucous or papillary type.

Miliary tuberculosis is very rare in the skin about the anus and is almost invariably a manifestation of an advanced stage of the disease elsewhere in the body. It develops as multiple shotlike nodules, grouped in crescents or circles beneath the skin. As the nodules enlarge, necrosis of the overlying skin occurs, resulting in small cup-shaped ulcers with ragged borders. The ulcers may remain separate but often coalesce, forming large ulcers, which resemble other tuberculous ulcerative lesions of this region.

Ulcerative Perianal Tuberculosis (Tuberculosis Cutis Ani).—The tuberculous process is primary here more frequently than in the rectum, large or small bowel, but may be secondary to foci in the lungs or intestines. The disease begins insidiously in the perianal skin or in the anal canal below Hilton's white line and tends to eventually involve both. At first the skin is infiltrated, reddish-hued, or elevated by scattered millet-seed size or conglomerate tubercles. Disintegration of the tubercles produces the characteristic tuberculous ulcers. Traumatism or injury hastens the disintegration. The ulcers are usually superficial, but may be deep; are single, or several ulcers developing at the same time may coalesce into one large ulcer.

A typical tuberculous ulcer is irregular in shape, the clear-cut margin is tapering and pinkish or more often ragged, sloughing and undermined. The base of the ulcer, raised at the center and depressed at its edges beneath the undermined skin, is covered with irregular, pale granulations (worm-eaten), and at times is spotted with small yellow tubercles. A scant watery or thicker purulent discharge is noted especially at the margins of the ulcer, but the indolent granulations show less tendency to bleed than other types of ulceration of similar size. Tubercle bacilli cannot be demonstrated in the discharge, although they are frequently found in scrapings from the ulcer. A deposit of fibrous tissue beneath or encircling the ulcer tends to stay its progress and imparts a feeling

of induration. The ulceration may involve one side of the anus only, or partially, or almost completely surround the orifice, as in four of Hartmann's cases.

Case.—J. B., male, aged forty-four years, developed tuberculosis cutis ani secondary to pulmonary tuberculosis. The local lesion progressed steadily but slowly despite various forms of treatment, including colostomy, until at the end of two years he succumbed to the primary condition (Fig. 222).

When extension occurs to the anal canal, unlike a fissure, tuberculous ulceration tends to spread broadly, involving most or all of the lining membrane, and



FIG. 222.—TUBERCULOSIS CUTIS ANI.

Male, aged forty-four, with active pulmonary tuberculosis.

upward to the sphincter where it may end abruptly. Pain, generally, is comparatively less in tuberculous than in other ulcers of the anal canal and its margin. While this is the rule, marked pain occurs in some perianal cases, and when the anal canal is involved it may be severe, as in true fissure, during defecation or local examination. When the sphincter is relaxed the pain is trifling.

The course of these ulcers varies greatly, some spreading slowly, while others rapidly destroy the skin, perianal muscles and lower rectum, and form vaginal or other fistulæ. Without treatment the tendency is to spread in all directions. Usually anal and perianal tuberculosis is not fatal, but it persists as a debilitating factor until the patient succumbs to tuberculous foci in the lungs or else-

where. Pulmonary involvement is much more frequent in anal canal than in perianal tuberculosis.

A striking pathologic characteristic of the tuberculous process, wherever situated, is the tendency to form a wall of connective tissue around the tuberculous focus. This increase in connective tissue represents the protective response on the part of the tissues adjacent to the point of infection, and is in proportion to the natural resistance possessed by the individual patient. This wall may be thin and too feeble to stay the tuberculous process, but when relatively thick

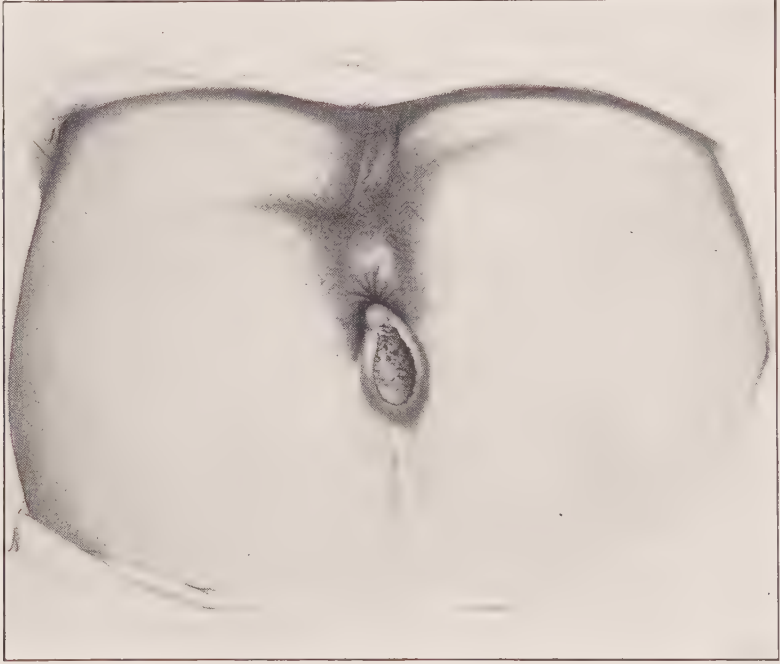


FIG. 223.—TUBERCULOSIS CUTIS ANI.
Male, aged twenty-four.

and cicatricial it is nature's effective barrier to progress of the disease. The explanation rests in the fact that scar tissue contains few blood-vessels and no lymphatics, the two common lines of tubercle spread.

Lupoid Ulceration.—This type of ulceration, formerly thought to be syphilitic, is now known to be tuberculous. It is essentially a destructive lesion, but progresses slowly. This rare form of ulceration begins as a small nodule in the skin at the mucocutaneous margin of the anus or vulva. Other nodules may develop, so that after many months a raised patch of some size is produced. Ultimately the nodules break down, forming superficial, rarely deep, ulcers with sharply defined, irregular edges, slightly undermined. The base is indurated and the discharge thin and seropurulent. Sometimes the discharge dries, forming a crust over the ulcer (*lupus exedens*). Once formed, the lupoid ulcer does not

differ markedly in appearance from other tuberculous ulcers, but is distinguished by its slow progress and a tendency to cicatricial healing in certain areas. However, the uneven pale or bluish scars soon break down and spread beyond the original limits of ulceration. Finally large areas of skin about the anus and vulva and even the lower rectum may be destroyed in its steady march. Lupoid ulcers are not very sensitive, but the feces irritate them and the discharge causes pruritus.

Lupoid ulceration may be primary, but is frequently secondary to other tuberculous foci. Unhealed cases run a fatal course in from one to three years.

Possible primary tuberculous lesions in the lungs, intestine, prostate and elsewhere are excluded by careful physical examination.

Differential diagnosis from epithelioma of the anus is made in doubtful cases by finding epithelial pearls in a biopsy specimen, and from ulcerative elephantiasis by the characteristic deformity due to lymphatic obstruction and hypertrophy of the skin and subcutaneous tissue. A Wassermann blood-test is important in differentiating the gummatous lesions of syphilis. The discovery of tubercle bacilli and giant-cells in scrapings or tissue removed from the lesion is conclusive for the diagnosis.

Verrucous Tuberculosis.—Verrucous tuberculosis of the perianal skin is a very rare manifestation of pulmonary tuberculosis. The small wartlike vegetations, situated on an indurated base, break down into ulcers and give off an abundant purulent discharge which irritates the skin.

Treatment of Perianal Tuberculosis.—Tuberculous ulceration in this region as elsewhere is difficult to control or cure. Success depends in large measure on the general condition of the patient. Primary ulcers are most amenable to treatment. Secondary lesions respond much more favorably to treatment, when the primary focus in the intestine, lungs, or elsewhere is quiescent than when it is active. For these reasons measures of hygiene and diet directed toward building up the general condition of the patient and increasing his resistance play the major rôle in the treatment.

Various agents have been employed in the local treatment of the tuberculous ulcers. Of those recommended, the best are silver nitrate, 5 to 10 per cent; argyrol, 20 per cent; balsam of Peru, 25 per cent, three times weekly; and methylene-blue, 2 to 10 per cent aqueous solution, applied daily, is safe and often very effective. Powders locally tend to cake and irritate, but occasionally they allay irritation and promote healing. After cleansing the ulcer with peroxid of hydrogen and drying, the powder is applied.

R Bism. subnit.
Orthoform āā 5 ii
Sig. Apply b.i.d.

Exposure of the lesions to the direct rays of the sun for several hours dries the ulcers and stimulates healing. A similar effect under better control is obtained by use of the carbon or mercury arc quartz lamp.

Therapeutic doses of the Roentgen ray have produced excellent results in several of the writer's cases of tuberculous fistula and ulceration. Carefully graded doses of one-fourth to three-fourths of an erythematous dose are administered at intervals of two or three weeks.

Overhanging skin edges and excrescences are removed more safely by fulguration than by the curet or scalpel. Fulguration of the entire base of a sluggish ulcer, followed by topical applications, has stimulated healing in some cases.

Lupus ulceration is treated on the same general principles already outlined. Fulguration is indicated to destroy the undermined, necrotic edges of ulcers. The Finsen light (phototherapy) is a tedious form of treatment, but it yields excellent results in lupus. The x-ray is also effective and more available, but time-consuming. Zinc cataphoresis is praised highly by some writers, a single treatment sometimes producing a cure.

Temporary Colostomy.—When tuberculous ulceration of the perianal skin or within the anal canal progresses, despite therapy, the parts are irritated and painful from fecal and other discharges, or cicatricial narrowing or stenosis of the anal canal develops as a result of the process, a temporary colostomy under local anesthesia should be established. Thereby sources of irritation are removed which gives the ulcers a much better chance to heal. If this occurs, the colostomy may be closed and continuity of the bowel restored.

TUBERCULOSIS OF THE SIGMOID AND RECTUM

Tuberculosis of the colon and rectum may occur as *miliary tuberculosis*, *tuberculous ulceration* or as a *hyperplastic tuberculosis*.

Primary infection of the intestine is rare. Autopsies in 22,725 cases of tuberculosis collected by Gant, showed the disease to be primary in the intestine in 7.22 per cent. Bovaird's figures indicate that it is more commonly primary in England and France than in America or Germany. Primary infection of the intestines is more common in children than in adults.

In the vast majority of cases the intestinal involvement is *secondary* to tuberculous foci elsewhere in the body. At death from pulmonary tuberculosis, autopsies show tuberculous intestinal lesions in from 50 to 80 per cent of all cases. Children swallow the sputum but rarely have lung cavities or other open lesions, and secondary intestinal involvement is less frequent than in adults. In Biedert's collected series of 1,346 autopsies in tuberculous children, the intestine was involved in 31.6 per cent.

Intestinal infection may occur through the blood stream or lymphatics (Lenoble), by direct extension from other organs, but it is chiefly by contact of swallowed sputum. The acid gastric juice has only a slight solvent action on the sputum, thus together with the food, protecting the stomach and duodenum. The alkaline contents of the intestine dissolve the sputum and liberate the tubercle bacilli. Tubercle bacilli may also be ingested in the food and find lodgment in the intestine.

Two types of tubercle bacilli are distinguished, the human and the bovine. Park and Krumweide determined the relative frequency of the human and bovine types of tubercle bacilli in 412 persons who had tuberculosis in various forms:

	Human	Bovine
Adults (over 16 years)	269	1
Children (5 to 16 years)	45	9
Children (under 5 years)	66	22
TOTAL	380 (92.2 per cent)	32 (7.7 per cent)

The relatively large percentage of bovine intestinal infection in children under five years of age is accounted for by the fact that at this period milk is the major portion of their diet. With increasing care in the inspection of cattle, bovine tuberculosis from infected milk, butter or beef should be minimal.

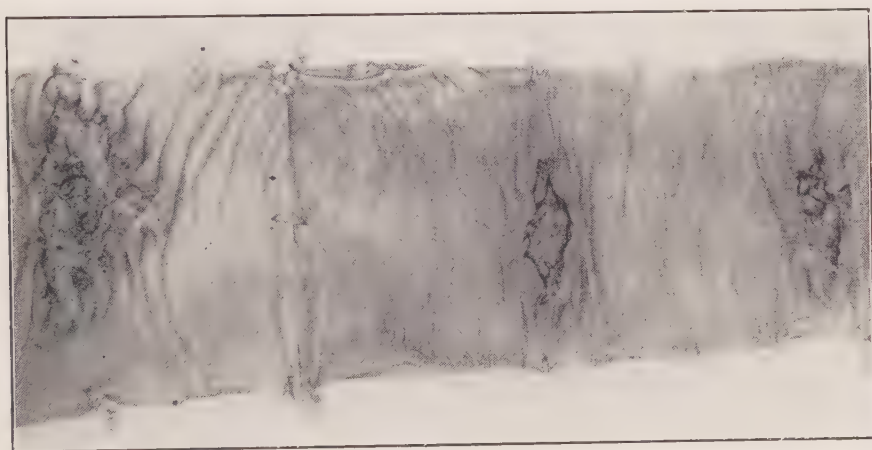


FIG. 224.—TYPICAL TUBERCULOUS ULCERS OF INTESTINE.
(City Hospital Museum, New York.)

The most common sites of infection in the intestinal tract are where digestion and absorption are most active (ileum, ileocecal region), lymphoid tissue most abundant, and where the intestinal contents are longest delayed. Prolonged contact of the tubercle bacilli with the mucosa is one of the most important factors in causation.

Fenwick and Dobell found the sites of the lesion at autopsy in five hundred secondary cases: Ileocecal, 85 per cent (in about 10 per cent limited here); ascending colon, 51.4 per cent; descending colon, 21 per cent; sigmoid, 13 per cent; and rectum, 14 per cent. In Fowler and Godlee's series of 323 cases the rectum was involved in 13.6 per cent. Schwatt and Steinbach, in 125 cases of pulmonary tuberculosis at the Montefiore Hospital, found tuberculous ulcers in the colon in sixty-three (50.4 per cent), and in the rectum in fifteen (12 per cent).

Although tubercle bacilli may pass through the intact intestinal mucosa, swallowed sputum and dietary indiscretions frequently cause a catarrhal condition which favors entry and implantation in the mucosa. Abrasions of the mucosa by hardened feces also favor infection.

Infection of the bowel wall occurs through invasion of the lymphoid or solitary follicles by the tubercle bacillus.

Miliary tuberculosis of the rectum is a rare manifestation of a generalized tuberculosis. It is frequently secondary to tuberculosis of the genito-urinary organs. In two cases observed by Tuttle, miliary tubercles developed in the anterior rectal wall following removal of tuberculous prostates. The miliary nodules feel like birdshot beneath the mucosa. For some time they may remain stationary, or break down, forming small cuplike ulcers. Coalescence of these ulcers results in larger, irregular lesions, or the ulcers may burrow and communicate with each other beneath the mucosa, so forming small submucous fistulæ.

Tuberculous Ulceration of the Rectum and the Pelvic Colon.—While exceptional as a primary condition, tuberculous ulceration of the rectum and pelvic colon is not uncommon secondary to tuberculosis of the lungs, larynx, small intestine, cecum or other portions of the colon. Direct infection of the solitary follicles produces a tubercle with a halo of congestion which undergoes caseous degeneration, resulting in an ulcer. The ulcers, originally round or oval in shape, spread by degeneration of their edges, or coalesce to form large areas of ulceration.

The ulcers tend to follow the course of the blood-vessels. Consequently, in the lower rectum, they extend in all directions, in the upper rectum transversely and in the sigmoid, as in the ileum, they tend to encircle the bowel. However, stricture seldom results, as this type of ulceration is essentially destructive, and there is little or no thickening of the bowel wall. As a result of inflammatory reaction, sufficient fibrous connective tissue is usually deposited beneath the ulcers to prevent extension to the muscularis and serosa. However, in some instances, secondary infection aggravates the ulcers and they may perforate the bowel wall, causing abscess, peritonitis or a fistula through the skin surface, into the vagina or bladder, or from the sigmoid into another portion of the bowel.

Symptoms.—The symptoms are much the same as in other ulcerative lesions of the rectum and pelvic colon, but naturally are much aggravated if the primary tuberculous focus in the lungs or higher levels of the bowel is active. The chief local symptoms of tuberculosis of the rectum and pelvic colon are pain, frequent passages and pathologic discharge. If the ulceration is limited, the discharge is scant, mucopurulent, blood-tinged and of fetid odor. Extensive lesions cause an abundant thin irritating discharge, and the frequent diarrheal movements cause tenesmus and irritability of the sphincter. Ordinarily the bleeding is slight, but J. M. Cruice collected twenty-six cases of large hemorrhage in tuberculous ulcerative colitis, and reported four other fatal cases. Brown suggests that the slow development of the ulcers may give ample time in most

cases for obliterative endarteritis or thrombosis to close the vessels before their walls are eroded. At the onset there is a feeling of fullness in the pelvis or slight lumbar or sacral pain. Later, pain is associated with the diarrhea and tenesmus. The pain is not acute at the site of ulceration unless the region of the sphincter below or the peritoneum above is involved. The diarrhea, at first slight, increases



FIG. 225.—INTESTINE IN GENERAL MILIARY TUBERCULOSIS.

Light areas are ulcers; nubs are tuberculous tissue. (Cornell University Medical College Museum.)

with extension of the ulceration, until the evacuations may number thirty or more daily.

Tuberculous rectal ulcers within reach of the finger give the impression of a soft granular mass on a firm base, with slightly thickened irregular edges. Through the proctoscope the irregular ulcerations show a gray, worm-eaten base sometimes dotted with tubercles, and slightly thickened, ragged, undermined edges. A mucopurulent discharge ordinarily coats the base of the ulcer, but in advanced cases a dirty gray inseparable slough may cover the ulcer; and

the surrounding mucosa be inflamed and edematous, as the writer observed in two instances.

Diagnosis.—The development of digestive disturbances, colicky pain and persistent diarrhea, eventually with pus and blood in the stools, in a patient having pulmonary tuberculosis, is very suggestive of tuberculous infection and ulceration of the bowel. Diarrhea due to dietetic errors, overeating, achylia and other causes, may occur in the tuberculous, but yields to therapy. The discovery of tubercle bacilli in the stools is *not* diagnostic, because they may be found in from 85 to 95 per cent of patients who have tubercle bacilli in the sputum. Tubercle bacilli might thus be found in the discharge of an ulcer which is not tuberculous. Viewed through the sigmoidoscope, tuberculous ulcers of the rectum and pelvic colon present the characteristics already described. If the lesions are above the field of the sigmoidoscope, fluoroscopy and roentgenograms after a barium meal or clysma embody the surest method of detecting them.

Syphilitic ulcers might lead to confusion, but they generally appear as punched out ulcers with a raised border and fibrous base, whereas tuberculous ulcers are irregular in shape, base worm-eaten and edges frequently undermined.

Initial tuberculosis of the rectum is very rare and its diagnosis difficult. Discovery of tubercle bacilli in scrapings from the ulcers would settle the question, as would demonstration of tubercles and giant-cells in tissue excised from the margin of an ulcer. Tuberculin is of no value in the diagnosis or treatment of secondary ulcerative tuberculous lesions of the bowel.

Treatment.—The results of treatment of tuberculosis of the rectum and pelvic colon are less encouraging than in anal tuberculosis. The patient should be warned of the danger of swallowing the sputum through which secondary infection of the bowel commonly occurs. He should wear day and night an abdominal woolen band next the skin, extending from the ensiform cartilage to the pubes. Chief reliance is placed in measures directed to overcome the primary condition, fresh air night and day, rest, and a nutritious diet.

Internal medication by drugs may aggravate an already disturbed digestion and is not curative, but may be necessary to control symptoms. Among these are the various preparations of bismuth to check the diarrhea, astringents by mouth and in enemas, opiates, as paregoric, or compound powder of opium (Br.) and salol, $2\frac{1}{2}$ grains each, after meals. Drucek recommends the internal administration of iodine pushed to the limit of tolerance. A freshly prepared 10 per cent tincture of iodine, without the iodide of potash, is used. In a half cup of cold milk, five drops, well stirred, are given three times daily. If tolerated well, the dose is increased by five drops every five days until fifty drops are taken at each dose. The course is then repeated.

Mandl first suggested the use of calcium chlorid. He thought that through its action on the vegetative nervous system it reduced peristalsis. The usual dose is 5 c.c. of a 5 per cent solution, given intravenously once or twice a week. To the patient four or five doses may be given and continued so long as it is effective. In seventy cases treated by this method, Roberts saw relief or improve-

ment of the gastro-intestinal symptoms in 80 per cent of cases and negative results in 14 per cent.

HELIO THERAPY.—Ultraviolet radiation has largely replaced surgery in the treatment of tuberculous ulceration of the colon. The quartz, mercury-vapor or carbon-arc lamp are substituted for natural heliotherapy, as a more convenient and easily applicable source of ultraviolet rays. Brown and Erickson record the results of ultraviolet-ray treatment in 209 cases studied at Saranac:

	<i>Living</i>	<i>Dead</i>
With ultraviolet-ray treatment	116 (65 per cent)	64 (35 per cent)
Without ultraviolet-ray treatment	5 (17 per cent)	24 (83 per cent)

Topical applications to ulcers within the field of the proctoscope are valuable. After cocainizing the parts, the application of pure crystals of potassium permanganate to the ulcers is frequently beneficial.

SURGERY.—Because of the primary condition, surgical intervention is seldom indicated, except for complications, such as perforation, peritonitis, abscess and fistula, and the prognosis is usually unfavorable. When surgery becomes necessary, stricture of the bowel may require enterostomy or other operative measures, but fortunately stricture develops very rarely in the pelvic colon or rectum in this type of ulceration.

Nikoljski's collected series of 159 cases shows the sites of stricture:

Small bowel	67
Cecum and ileocecal region . .	66
Ascending colon	21
Transverse colon	4
Rectum	1

Hyperplastic Tuberculosis.—In contrast to the destructive ulcerative type, hyperplastic tuberculosis of the colon and rectum is a distinctly chronic productive inflammatory process. Tuberculoma is a current term, for hyperplastic or neoplastic colon tuberculosis, of the French authors. The majority of cases occur between the twentieth and fortieth years of life, with an average of thirty-five years. Of sixty-three cases reviewed by Herrick from the literature since 1907, there were eleven in the second decade, twenty-three in the third, and eighteen in the fourth decade. Incidence is about equally divided between the sexes.

The condition is comparatively rare and is usually primary. Evidence of this is found in the one hundred cases collected by Mummery. No tubercles were found elsewhere in seventy-six of these cases, eighteen showed tuberculous lesions of the lungs, two of the urogenital tract and one each of the peritoneum, vagina, tibia and phalanges. In Herrick's series of sixty-three cases, no tuberculosis was found elsewhere in thirty-five, but twenty-nine showed other foci, thirteen of them in the lungs. These observations coupled with the fact that

excision is frequently followed by cure, corroborates the view that in the majority of cases hyperplastic tuberculosis is a primary condition. Infection may occur through the blood-stream or from the bowel lumen.

In most instances the process is confined to a definite portion of the colon, although two or more distinct lesions may be present, and exceptionally a large part of the entire colon is involved. The site of the lesion in Mummery's one hundred collected cases was: Cecum or cecocolon, ninety; whole colon, four; sigmoid, six. The rectum was the site in one case we observed.

Pathology.—The characteristic feature is a localized thickening of the bowel wall due to round-cell infiltration and deposit of fibrous tissue. The lesion may be limited to one side, but usually involves the entire circumference of the bowel. The bowel wall may be 1 or 2 centimeters thick and the cut surface presents the bluish-gray appearance of cartilage. The fibrous deposit is chiefly submucous, but is also subserous, the latter frequently showing spaces filled with yellow fat. The muscularis may appear thickened due to round-cell infiltration. The serosa is usually thickened, vascular, and occasionally dotted with tubercles, giving it a sandpaper appearance. The mucosa is thickened and usually intact, but may be the site of papillæ continuous with the submucosa, or ulcerated secondarily when stenosis has occurred. The lumen is constricted, in some cases to the point of occlusion. Consequently the bowel above the tumor is dilated and hypertrophied. The mesentery may not be involved, or it may be shortened and thickened by infiltration and by enlargement of its lymph-nodes. Histologic sections through the bowel wall often show, especially in the submucous thickened stratum, tubercles and giant-cells. The tubercles have no tendency to caseation, but instead show a fibrous center. The developed tuberculoma presents the appearance and conveys the impression of a malignant tumor. Indeed, differentiation sometimes can only be made by aid of the microscope.

Diffuse Type.—In a few reported cases, the process is not localized. The greater part or entire colon has undergone tuberculous infiltration, converting it into a contracted, fixed tubular structure, with an indurated, non-collapsible wall, described as "gas-pipe colon."

Symptoms.—As may be inferred from the pathology, the symptoms of hyperplastic tuberculosis are those of a slowly progressive obstructive lesion of the bowel which may end in acute obstruction, with associated digestive disturbances. Diarrhea may be an early symptom and, if ulceration occurs, blood may be present in the stools. Tubercle bacilli are scarcely ever found in the dejecta. The chronicity of the process is indicated by the fact that symptoms have usually existed from several months up to three or more years before the patients sought examination.

Physical examination may reveal a tumor in the lower abdomen or in the rectum. When the sigmoid or rectum is the site of a tuberculoma, differentiation must be made chiefly from carcinoma and chronic diverticulitis. For the rectal cases, biopsy is decisive for the diagnosis. For sigmoid involvement, roentgenologic examination demonstrates the site and extent of the lesions and is our

most valuable means of excluding diverticulitis. Hyperplastic tuberculosis on the average occurs in younger subjects than carcinoma and has a much slower course.

In practice, the correct diagnosis of the nature of sigmoid involvement is seldom made before operation, which is usually performed to relieve obstruction or the removal of a tumor presumably malignant. This is not of vital moment, as treatment is surgical removal, on the same principles as for carcinoma. Unfortunately, when adhesions have formed and the lymph-nodes are enlarged, the tuberculous mass may give the impression of an inoperable carcinoma, and the surgeon be content with a palliative colostomy rather than radical excision.

Treatment.—The treatment of hyperplastic tuberculosis of the colon is surgical, if feasible. For localized involvement of the sigmoid in a tuberculoma, resection and end-to-end anastomosis is indicated. If the colon above the growth cannot be emptied before operation, colostomy in the transverse colon is the safest measure. Excision of the rectum is indicated for tuberculoma of that organ. Too few cases involving the sigmoid and rectum have been operated upon, to warrant conclusions. However, 75 per cent or more of recoveries have followed excision or short-circuiting for ileocecal tuberculosis, and it is reasonable to infer that equally good results may be obtained in the pelvic colon and rectum.

REFERENCES

- BIEDERT, P. *Jahrb. f. Kinderh., n. F.*, Leipz., 1884, Vol. 21.
 BROWN, L., and SAMPSON, H. L. *Intestinal Tuberculosis*, Philadelphia, Lea & Febiger, 1926.
 CRUCE, J. M. *Med. Rec.*, N. Y., 1913, Vol. 84.
 DRUECK, C. J. *Fistula of the Anus and Rectum*, Philadelphia, F. A. Davis Co., 1927.
 ERICKSON, R. J. *Am. Rev. Tuberc.*, 1925-1926.
 FOWLER and GODLEE. *The Diseases of the Lungs*, London, Longmans, 1898.
 GANT, S. G. *Diseases of the Rectum, Anus and Colon*, Philadelphia, W. B. Saunders Co., 1923.
 HERRICK, F. C. *Ann. Surg.*, Phila., April, 1925.
 MANDL, D. *Ztschr. f. Tuberk.*, Leipz., 1913, Vol. 28.
 MUMMERY, P. L., *Diseases of the Rectum and Colon*, New York, Wm. Wood & Co., 1923.
 NIKOLJSKI, A. W. *Volkman's Samml. klin. Vortr., n. F.*, Leipz., No. 362, 1903.
 PARK, W. H., and KRUMWEIDE, C. *J. Med. Research*, Boston, 1911, 25: 313-333; 1912, 27: 109-114.
 ROBERTS, E. H. *Am. Rev. Tuberc.*, 1924, Vol. 9.
 SCHWATT, H., and STEINBACH, M. *Tr. Nat. Tuberc. Ass.*, 1922, Vol. 18.
 TUTTLE, J. P. *Diseases of the Anus, Rectum and Pelvic Colon*, New York, D. Appleton & Co., 1907.

CHAPTER XVIII

ACTINOMYCOSIS

Since 1878, when Israel discovered two cases of actinomycosis in human beings in the United States, the disease has been reported as involving almost every region of the body. The affection is common in animals. Sanford and Voelker have recently presented data of 680 cases in man, only five of which involved the anorectal region.

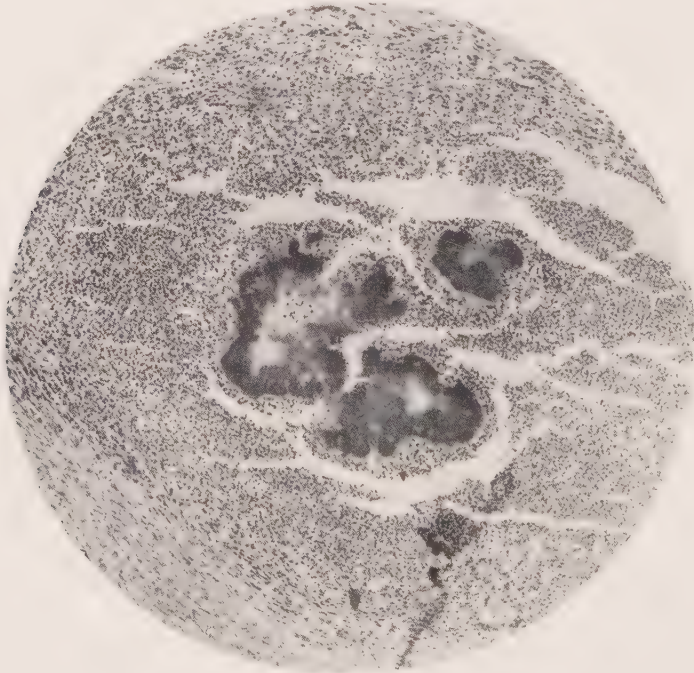


FIG. 226.—ACTINOMYCOSIS.

Photomicrograph of ray-fungi in tissues. (Courtesy of E. S. L'Esperance.)

The disease may occur at any age, but the majority of reported cases was between the third and fifth decades. Approximately 75 per cent of cases of actinomycosis is found in males, owing to their more frequent contact with cattle and contaminated vegetation, such as hay, straw and grain.

Actinomycosis is a chronic inflammatory condition due to infection by the pathogenic ray-fungus which Ponfick, in 1879, showed to be the identical organism in man and animals. Wolf and Israel advanced the theory that the ray-

fungus is a normal inhabitant of the gastro-intestinal tract, usually gaining access through some abrasion or with a foreign body. According to the more recent and quite generally accepted theory of Bostroem, the fungus is "capable of a dual existence, primarily as a saprophyte in old soil from which it gains access to grains and grasses, and through this medium becomes capable of infecting man and animals." Infection is direct, but it seems that the fungus probably always penetrates the tissues through an abrasion of the mucosa or skin. In some cases, particularly of the uterine adnexa, infection doubtless occurs through the genital tract. The fungus possesses marked vitality, and living spores have been found on dry grain several years old.

In the rectal region invasion of the disease is either primary or secondary. In the primary form the fungus gains access to the perirectal tissues through the rectal mucosa or the perianal skin. The rectal mucosa, in contrast to cancer and tuberculosis, is usually not involved, at least not primarily, the fungus passing through it to the perirectal tissues.

Secondary invasion of the rectum is somewhat more frequent and usually results from an extension of the disease from adjacent organs of which the uterine adnexa is the most important. Sometimes the disease originates in the rectum and invades the pelvic viscera. Of thirty-one cases of actinomycosis of the tubes and ovaries collected by Helwig, including one of his own, four originated in the rectum, one in the sigmoid and one in the mesosigmoid.

Pathology.—The inflammatory process induced by the actinomycotic fungus is essentially chronic, lasting months or years, but rarely it is acute and fulminating, terminating fatally in a fortnight. Extension occurs through continuity of the involved tissues. The lymphatics take little or no part in transmission of the infection. Distant metastases occur through the blood stream. The invasive lesions are characterized by the formation of granulomatous masses resembling tuberculosis. Mixed infection soon follows, particularly in cases near the intestinal tract, resulting in necrosis and multiple abscesses. The latter may open on the skin or rupture into the hollow viscera, forming sinuses or fistulæ. In the necrotic tissue and pus contained in the abscesses and discharging sinuses, small yellow granules, known as sulphur granules, may be found. These contain the ray-fungi which establish the diagnosis.

In the rectum, actinomycosis tends to invade the perirectal spaces rather than the gut proper. Invasion of the bowel wall may result in cicatricial narrowing of the rectum.

The disease may be implanted on a rectal fistula, as Warthin reported in two cases. Primary involvement of the perianal skin is rare, although the use of straw or grass as a detergent may cause primary infection of this region, as occurred in Nové-Juseaud's patient, a man of sixty-five years. McWilliams reported a case of postanal actinomycosis which healed after a second excision of the lesions three years after the first operation.

The most common sites of actinomycotic infection in the order of their frequency are the head and neck, the abdomen and the thorax. In the intestines,

the appendix and cecum are most frequently involved, then the colon and rectum, but the small bowel usually escapes.

Symptoms.—These vary with the duration of the disease and whether it be primary or secondary in the rectum or sigmoid. In the primary form there may be diarrhea, tenesmus and the passage of blood and pus. Perirectal abscesses pointing into the ischiorectal fossæ or postanal region may occur early, resulting in fistulæ with abundant purulent discharge. Granular vegetations may obscure the orifices of the fistulæ. When the skin is primarily involved, it soon becomes brawny, hypertrophic, fissured and necrotic, the site of vegetations, and is of a violet color.



FIG. 227.—ACTINOMYCOSIS OF OVARY.
(Courtesy of E. S. L'Esperance.)

In the secondary form, the primary focus, usually in the adnexa, bladder, peritoneum or pelvic connective tissue, may mask the symptomatology until an abscess ruptures into the rectum or symptoms of obstruction ensue, due to pressure from without or cicatricial stenosis of the rectal lumen. Occasionally nervous manifestations, such as agitation, marked pain and delirium, have been observed, due presumably to irritation of the nervous system by a toxin secreted by the fungus.

Case.—G. F., a girl aged nineteen, for several months complained of diarrhea with the passage of egg-yolk stools, and later nausea and vomiting. The temperature was irregularly elevated and there was progressive loss of weight and strength. At a height of 3 inches, the rectum was constricted, especially on its anterior surface, by smooth indurated ridges. Proctoscopy showed an intact mucosa only slightly inflamed. The left tube and ovary were removed, but later an abscess and fistula formed in the buttock, the patient dying of a low-grade infection three months after the laparotomy. Autopsy showed actinomycosis of pelvic connective tissue, wide extension and abscess formation beneath the pelvic fascia, fibrinous peritonitis and infiltration and ulceration of the rectum (Fig. 228).

Diagnosis.—Owing to the insidious nature of actinomycosis, diagnosis is usually made late, particularly when the pelvirectal spaces and the rectum are

invaded secondarily in the disease. Even at operation, actinomycosis is frequently mistaken for carcinoma or tuberculosis. The pathologist usually makes the diagnosis. When abscess, pus pockets or fistulæ are present, discovery of the characteristic sulphur granules is diagnostic, but unfortunately they are not always in evidence. They are best demonstrated by placing a drop of pus on a slide and adding potassium hydroxid, 10 per cent, or picrocarmin. In addition

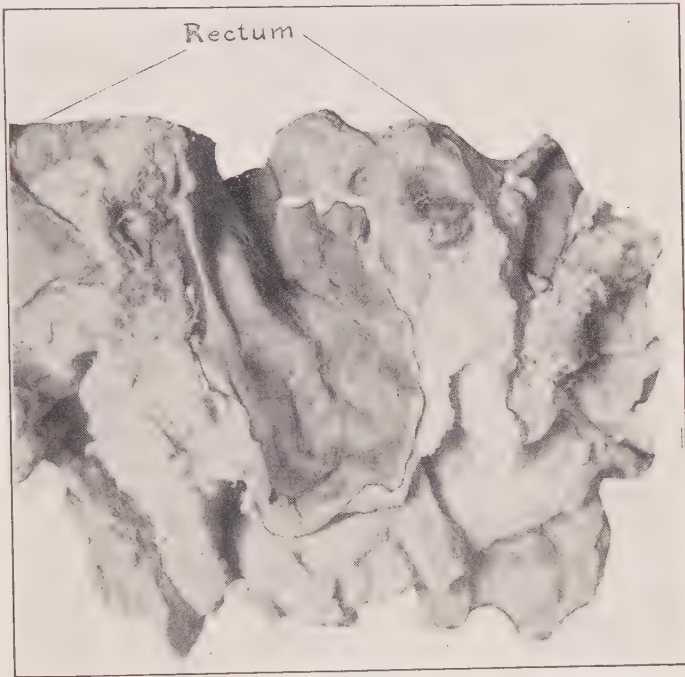


FIG. 228.—ACTINOMYCOSIS OF RECTUM AND PELVIS.

Girl, aged nineteen years, New York Hospital. Note small lumen of rectum and enormous thickening of rectal wall. (Courtesy of E. S. L'Esperance.)

to the gross demonstration of the granules, diagnosis rests on finding the organism in sections of tissue or its successful cultivation.

Histologic examination of involved tissue differentiates actinomycosis from tuberculosis and cancer.

Prognosis.—Prognosis is usually unfavorable. Of fifteen cases reported by Thevenot, seven died, four could not be traced, three improved, and only one was apparently cured. In Helwig's collected series of thirty-one cases of actinomycosis of the uterine adnexa, twenty-one died at periods varying from three months to six years after the primary operation. Incomplete excision results in recurrences and extensions.

Treatment.—Treatment is usually protracted. Of the drugs employed, iodine in the form of potassium iodid has given the best results. Ochsner reported improvement or cure in a number of cases of general actinomycosis with large

doses of potassium iodid. A dose of 60 to 90 grains of the drug in a glass of milk and followed by a pint of hot water is given every eight hours for four days. The course may be repeated at weekly intervals.

In cases intolerable to iodine, Judd used a stock vaccine of actinomyces with good results.

Repeated surgical intervention is frequently necessary to evacuate pus pockets and drain sinuses. The best surgical results are secured by radical excision, but the extensive involvement frequently precludes this procedure. Partial excision and curettage of sinuses tends to spread the disease. Fistulæ and sinuses may be injected with a 1 per cent copper sulphate solution or a weak solution of formalin in glycerin.

Radium has been very effective for surface lesions. Heyerdahl reports twenty-one cases of actinomycosis of the face and neck all cured by radium without a relapse. It is to be observed, however, that lesions in this location respond more readily to treatment than those situated in the abdomen or pelvis. Fischer and Wohler reported a cure in a case in which the intravenous injection of fluid charged with radium emanation was employed.

REFERENCES

- HELVIG, F. C. *Surg., Gynec., & Obst.*, Chicago, 1925, 40: 502.
 HEYERDAHL, S. A. *Brit. J. Radiol.*, Vol. 31, Jan., 1926.
 ISRAEL. *Arch. f. path. Anat.*, Berl., 1878, Vol. 74.
 McWILLIAMS, C. H. *Ann. Surg.*, Phila., 1917, 66: 117.
 OCHSNER, A. J. *Practical Medical Series*, Chicago, 1919, Vol. II, p. 573.
 PENFICK, Emil. *Die Actinomycosis*, Berlin, 1882.
 SANFORD, A. H., and VOELKER, M. *Arch. Surg.*, Chicago, Dec., 1925, 2: 809-841.
 THEVENOT, L. *Rev. de chir.*, Paris, August, 1902, p. 250.

CHAPTER XIX

VENEREAL DISEASES OF THE ANUS AND RECTUM

Venereal diseases of the anus and rectum are comparatively rare in the United States, but they are encountered with sufficient frequency both in hospital and private practice to engage attention.

The principal venereal diseases affecting the anus and rectum are gonorrhea, chancroid and syphilis.

GONORRHEA

Neisser discovered the specific coccus of gonorrhea in 1879, and Bumm, in 1884, was the first to demonstrate it in the rectum. Earlier writers recognized the nature of gonorrheal proctitis, but could not prove that it was a specific infection prior to the discovery of the coccus by Neisser. It seems quite probable that a considerable number of cases of proctitis are initiated by a gonorrheal infection, the organism later disappearing from the discharge.

Etiology.—The cause of this disease is direct inoculation of the mucosa of the rectum or anus by the gonococcus. In men this usually occurs through the practice of sodomy, but in clinics where many cases are treated by prostatic massage the infection has been carried to the rectum by the contaminated finger or glove. Likewise a contaminated syringe tip may convey the organism.

The disease is more common in women than in men and is usually due to infection by the vulvovaginal discharge. Huber found the rectum involved in 78 (24.5 per cent) of 318 cases having vaginal gonorrhea; Baer, in 163 (38 per cent) of 429 cases; and Jullien collected 1,037 cases of which 157 (15 per cent) had gonorrheal proctitis.

In infants and children having gonorrheal vaginitis, rectal infection is in general a rare complication. In institutions for children, however, secondary rectal infection has occasionally been almost epidemic. Fortunately gonorrheal vaginitis in children tends to spontaneous cure at puberty.

As a result of gonococcal infection, the rectal mucosa becomes acutely inflamed, swollen and edematous. The epithelium is exfoliated and superficial ulcers frequently result. The gonococci are practically confined to the superficial layers of the mucosa, but by injury to the mucosa, paths are opened for secondary infection and inflammatory infiltration of the muscularis. Rarely periproctitis may result in abscess and fistula. The rectal mucosa of healthy individuals is notably resistant to gonorrheal infection and the majority of cases in this situation appear to be self-limited. In all of our seven cases, diagnosed positively by finding the specific organism, the inflammatory process was con-

fined to the rectum. However, Pennington reported one case in which the entire colon was involved and Bieck observed extension to the colon in forty-two cases. Presumably secondary infection played the major rôle in these cases of wide extension.

Stricture developed in only one of 163 cases of gonorrheal proctitis reported by Baer. Fissure, submucous fistula and condylomata may be complications.

Symptoms.—In women, the rectal symptoms usually follow evidences of vulvovaginal gonorrhea. From one to five days after exposure, the patient experiences sensations of fullness and itching about the anus, which rapidly become distinctly burning and painful in character. There is a dull ache over the sacrum and pain at defecation tends to induce constipation. Tenesmus is followed by the passage of mucus and pus, sometimes admixed with blood, which irritates, macerates and excoriates the anal canal and perianal skin, thus greatly increasing the general discomfort. The discharge, at first milky, later becomes greenish yellow and abundant and may seep through the anus. At the height of the inflammation, mild constitutional disturbances, as malaise and moderate elevation of temperature, may occur.

Diagnosis.—The history is frequently misleading, especially when the disease is contracted through sexual vice, but the relaxed sphincters and free discharge are telltale evidence in this type of case. In cases contracted innocently the sphincters are more apt to be spasmodic. The presence of gonorrhea of the genitals is very suggestive, but the discovery of the gonococcus of Neisser in the discharge is decisive for the diagnosis. Unfortunately in the chronic stage the normal intestinal flora, *B. coli*, staphylococci and streptococci may supplant the gonococci, and they can no longer be found.

Treatment.—Prompt treatment of anal gonorrhea will usually prevent its extension to the rectum and result in an early cure. Hot sitz-baths of potassium permanganate solution (1:10,000 or 1:5,000) two or three times a day; and local applications of argyrol, 25 per cent, are indicated. A pledget of cotton sprinkled with an inert powder, such as stearate of zinc or aristol, is worn between the buttocks to absorb the discharge and prevent chafing. Sluggish ulcers should be touched with 10 per cent silver nitrate or painted with 2 per cent mercurochrome solution.

Patients suffering from gonorrhea of the rectum should rest in bed during the acute stage. For severe tenesmus and pain, a suppository containing belladonna and opium should be inserted into the rectum. With the patient in the Sims' or lithotomy position, the rectum should be irrigated for fifteen minutes twice daily through a recurrent catheter passed just through the anal canal. Plain water or 2 per cent boric acid solution at 110° F. is employed and after all the fluid has returned, 1 ounce of 25 per cent argyrol solution is injected to be retained as long as possible, and the catheter is withdrawn. It is important to employ irrigations and not enemas. In practice the latter appear to have carried the infection upward into the colon.

In the average case, treatment as outlined causes rapid subsidence of the

acute symptoms and discharge, but sometimes a catarrh with slight mucous discharge persists for a long time. Residual ulceration may require topical applications through the proctoscope of argyrol, silver nitrate or iodine in glycerin.

Concomitant disease of the genital organs, if present, should receive appropriate treatment. Complicating fissures, fistulæ or condylomata are treated upon the principles outlined elsewhere in this work.

CHANCROID

Chancroid infection about the anus or within the rectum is a rare condition. Fournier found the disease in one of 445 men and in one of nine women having venereal diseases. The incidence in women is much greater than in men. The disease is usually found among the debased classes who are careless in their sexual habits and hygiene. In the majority of cases anal chancroids are secondary to chancroids elsewhere and are frequently due to auto-inoculation by vaginal discharges. Primary infection of the anus or rectum may occasionally occur by contact with the penis during coitus or may be due to sodomy.

Chancroids are due to an infection and the specific agent is generally considered to be the bacillus of Ducrey. A perianal chancroid usually begins as a small pustule ringed by a red areola. Rupture of the pustule results in an ulcer with clean-cut, undermined edges and a pliable grayish base. Peripheral extension of the ulcers is characteristic and the abundant, foul, acrid discharge is prone to inoculate adjacent surfaces. As a consequence chancroidal ulcers are usually multiple and frequently coalesce to form larger irregular ulcerations. The ulcerations are superficial and show no tendency to subcutaneous burrowing, but the inguinal lymph-nodes usually swell and may suppurate (bubo).

Perianal chancroids may involve the anal canal, but rarely extend above the mucocutaneous border unless they assume the phagedenic type. Then they may destroy the mucosa and even the muscular coats of the rectum. Generally the closed sphincter and the downward sweep of the fecal current are effective barriers against invasion of the rectum.

Chancroids in the anal canal appear as long, grayish-yellow fissures between the folds. Here, one sulcus after another is infected, until the entire anal ring may be involved. In this situation the process is essentially chronic and healing is equally slow. Features that distinguish them from simple fissures are the presence of chancroids elsewhere in the body, their sluggish appearance, abundant purulent discharge, and the fact that they are usually multiple. Pain and tenderness are as severe as in an ordinary fissure. This induces constipation and reflex digestive disturbances.

Occasionally, as on the genitals, there is a mixed infection, chancroid and syphilis. Induration developing in a chancroidal ulcer suggests true chancre, and demonstration of spirochetes under the dark field of the microscope in secretion, expressed from the cleansed lesion, would confirm the diagnosis of syphilis.

Treatment.—Without treatment, chancroidal ulceration tends to extend rather than to heal spontaneously. In the early stages the ulcers respond favorably to treatment, but usually the process is well advanced before the physician is consulted, especially when the disease occurs in victims of perverted sexual practices.

The bowels should be moved by mild laxatives. For chancroids of the perianal region the parts should be cleansed frequently with hot water, followed by black wash, dried, and dusted with a powder consisting of equal parts of oxid or stearate of zinc and calomel. A pledget of cotton is worn between the buttocks to prevent chafing. Chancroidal ulcers within the anal canal are difficult to treat, because spasm of the sphincter prevents easy access. Stretching or division of the sphincter would overcome this obstacle, but these measures open the lymphatics to infection and possible septicemia. They should, therefore, be avoided if possible. A safer and better practice is to administer nitrous oxid gas and cauterize the exposed ulcers lightly with the actual cautery or phenol followed by alcohol, and insert a wick of vaselin gauze through the anal canal. Later, analgesic powders, as orthoform or anesthesin, combined with calomel and zinc oxid, should be applied. Solutions of methylene-blue, 10 per cent, ichthyol 25 per cent, and silver nitrate, 5 per cent, stimulate healing. Their application is facilitated by hot fomentations to overcome the spasm and by previously desensitizing the parts by a pledget of cotton saturated with a 20 per cent solution of cocain.

Chancroids which do not yield to the above treatment may be cured by electrothermic desiccation. After anesthetizing the area by the topical application of cocain, a fine current is used to destroy the ulcerated surface which is allowed to slough away.

Chancroidal Ulceration of the Rectum.—This is an exceptional condition. It may possibly result secondarily from an ascending infection, but true chancroid originating in the rectum is usually due to sodomy. They excite the same symptoms as other ulceration of the rectum—diarrhea, tenesmus and a profuse purulent discharge, sometimes blood-tinged. Pain is not notable unless the anus is involved.

Treatment by irrigations and topical applications is practically the same as for other acute ulcerations of the rectum.

Complications.—Just as in any other suppurative process in this region, abscess, fistula and rarely stricture may occur as complications. Occasionally in anal chancroids submucous tracts form beneath the columns of Morgagni. Unless they are detected by examination with a fine probe, laid open and carbolized, discharge from them prevents the ulceration below in the anal canal from healing.

Phagedenic Ulceration.—Under certain conditions not fully understood, and particularly in debilitated individuals, any of the ulcerative processes occurring in the anal skin, anus or rectum may show a marked tendency to spread, with infiltration and undermining of the deeper structures, destruction and

sloughing of tissue, edema and pain not unlike a cellulitis. There may be more or less constitutional reaction, with elevated temperature, rapid pulse and prostration. Chancroidal ulceration most frequently assumes these phagedenic characteristics, and probably depends on the auto-inoculability of the Ducrey bacillus or its toxin. In the chronic form, the ulcers tend to spread and may be healing at one side while extending on the other. In rare instances they may invade the rectum and result in stricture, or undermine the mucosa and lead to abscess with subsequent fistulæ.

The treatment in the acute forms should be similar to that of cellulitis, freely incising indurated tissues, evacuating and draining abscesses and applying large, warm and moist antiseptic dressings. The toxemia may require supportive measures of which blood transfusion is one of the best.

In the chronic form, caustics, such as silver nitrate, chromic acid, nitric acid and phenol, or the application of the actual cautery seem to be the measures of most value. Excision of the phagedenic area has been practiced, but with varying success. Cases requiring colostomy to check the disease must be exceedingly rare.

Kingsbury and Peck report that phagedenic ulcerations of the genitals, which had not responded to local treatment, were rapidly healed by intravenous injections of antimony. This treatment should be used only in cases with rapid and deep ulceration. The best preparation is a 1 per cent solution of antimony and potassium tartrate, supplied in ampules of 5 or 10 c.c. An initial dose of 3 c.c. is given to test the patient's reaction to the drug. The amount is then increased by 1 c.c. at each dose until a maximum of 10 c.c. is reached. Each week three or four injections are given. In phagedenic ulceration, treatment is continued until epithelization is complete.

Jones believes that the period of convalescence and hospitalization of patients suffering from chancroidal ulceration and its complications will be reduced at least 50 per cent if, in addition to local treatment, antimony and potassium tartrate is administered intravenously.

GRANULOMA INGUINALE

The infectious granulomata are venereal diseases of the tropics, but several instances of granuloma inguinale have been reported in the United States since Symmers and Frost, in 1920, recorded a case occurring in Bellevue Hospital, New York. The developed lesion is destructive and consists in exuberant, red granulations of soft consistency. Beneath the scanty mucopurulent exudate the surface is granular and the base fibrous. The process, initially localized to the pudenda in women, extends to the inguinal glands; may involve the perianal region and invade the vagina, with occasional resultant rectovaginal fistula.

The specific infective agent is a bacillus described by Donovan in 1905, which may be demonstrated in smears of the exudate, stained by the Wright or Giemsa method. These organisms are known as Donovan bodies.

Discovery of the Donovan bodies differentiates granuloma inguinale from

other lesions with which it may be confused, viz., syphilis, phagedenic ulcer and tuberculosis.

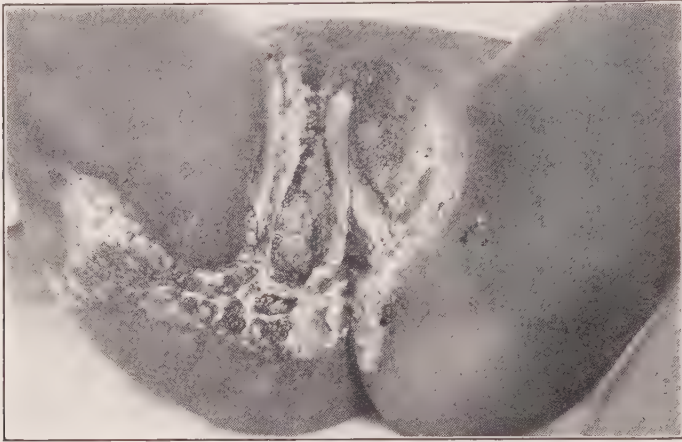


FIG. 228-A.—GRANULOMA INGUINALE.
(Courtesy of E. A. Schumann.)

The specific treatment of granuloma inguinale is by the intravenous administration of tartar emetic in $\frac{1}{10}$ grain doses, once or twice weekly, over a long period.

SYPHILIS

Primary, secondary and tertiary lesions of this protean disease are rare in the perianal skin, anal canal and the rectum. The disease may be congenital but usually is acquired. Its lesions in the anorectal region are seldom primary, but usually are secondary manifestations of syphilis elsewhere in the body.

Chancre.—Chancre is always the primary lesion of syphilis. In men, if the initial lesion is found in this region, it almost invariably is due to sodomy, but in women infections may occur through contact with the male organ. Inoculation is rarely accidental through the use of contaminated towels, sponges and syringes. Chancre of the anus is less frequent than in other extragenital locations. According to Bulkley, Quénu and Hartmann, of 10,836 extragenital initial lesions, 139 were at the anus. In 1897, Fournier published statistics of ten thousand chancres, fifty-two of which were in the anus and rectum; thirty-seven were in men and fifteen in women. The proportion of extragenital chancres occurring at the anus is greater in women than in men. The collected statistics of Peau and Malassez showed that of 1,237 extragenital chancres in various regions in men, seven (0.56 per cent) were at the anus; of 175 in women, fourteen (8 per cent) were at the anus. Martin and Kallet recently reported twenty cases diagnosed positively as chancre among three hundred proctologic cases examined during one year at the rectal clinic of the Receiving Hospital,

Detroit. They were impressed with the frequency of its occurrence and concluded that similar conditions exist in other large cities, but that anorectal chancres are frequently overlooked.

The chancre appears from two to four weeks after exposure; is usually situated on the anal margin, most commonly at the posterior commissure, and very rarely at a higher level within the anal canal or rectum.

The developed chancre appears as an ulcer with sharply defined edges, not undermined; reddish, smooth base which, when grasped between the fingers, gives the impression of a cicatricial thickening rather than the parchment-like induration characteristic of genital chancre. The exudate from the ulcer is serous rather than purulent and very acrid. Abundant discharge is evidence of a mixed infection. The discharge irritates the perianal skin, producing papules which may become superficially eroded.

If the true nature of the condition is recognized at this stage and suitable treatment given, the lesions heal rapidly in two to four weeks with slight or no scarring. In neglected cases, mixed infection stimulates epithelial hypertrophy until slightly

elevated condylomatous overgrowths, encircling the anus, may obscure the primary lesion. Their thin exudate is foul and of a musty odor. The inguinal lymph-nodes on each side are markedly enlarged, but do not suppurate, which is a diagnostic point in favor of syphilitic as against chancroidal infection.

Mixed Sores.—As described in a preceding section, simultaneous infection with the virus of syphilis and chancroid may result in a mixed sore.

Symptoms.—Chancres situated below the sphincter are less painful than simple ulcers, but when located within the grasp of the sphincter, pain is severe as in true fissure. They always cause more or less local discomfort, which is aggravated by the irritating seropurulent discharge. In its initial stage chancre

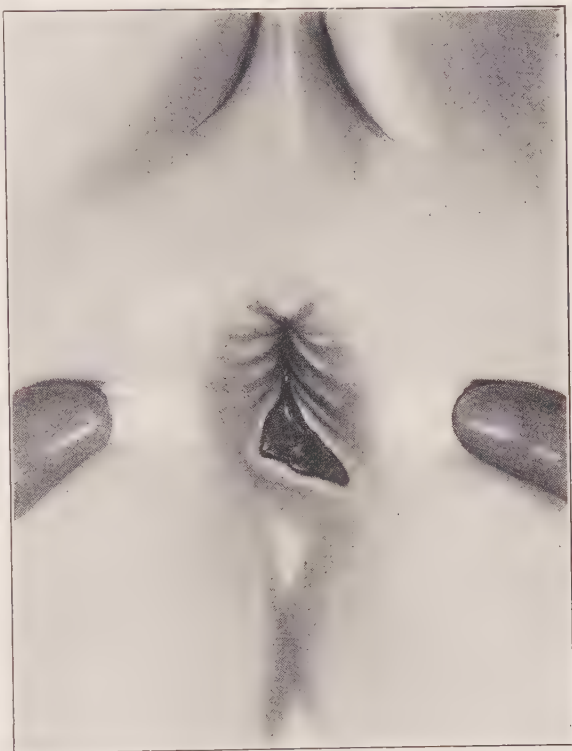


FIG. 229.—PRIMARY CHANCRE OF ANUS.
Man aged twenty-six. Spirochetes found under dark field.

between the radial folds or at the anal margin closely resembles simple fissure, but in about two weeks the characteristic induration develops. In some cases, the pain and discomfort are so slight that relief is not sought until the induration and secondary lesions have developed. Induration was already present in all of the five cases seen by the writer, four in young men and one in a woman. If an ulceration in this region is at all suspicious, a dark field examination of the exudate from the sore, or of fluid aspirated from the enlarged inguinal glands for spirochetes, should be made. This often clinches the diagnosis in chancre before the Wassermann blood-test is positive. Martin and Kallet found the Wassermann positive in five and negative in eight of thirteen cases of primary anorectal syphilis diagnosed by finding spirochetes in the dark field. In one case, with a negative dark field a positive Wassermann was obtained. Hence, if one test is negative, the other should be made without waiting for development of the secondary lesions.

Treatment.—The general treatment is by preparations of arsenic, mercury and bismuth given intravenously, intramuscularly or by mouth. The initial lesion should be kept clean and dry and a powder, consisting of equal parts of calomel and starch or bismuth should be applied on absorbent cotton. With this combined treatment the chancre usually heals in three to four weeks.

Secondary Manifestations.—Corresponding in time to the macular eruption upon the skin, *mucous patches* frequently develop in and around the anus. They resemble those in the buccal cavity where they occur more frequently. Their incidence is greater in women than in men, and in many cases they spread from the vagina to the anus. The patches are usually multiple, involving all of the perianal skin. The slightly elevated plaques are of a pearl-gray color. In the course of their development the patches become more elevated, are flattened by pressure of the buttocks, exude a thin, fetid, irritating fluid and are known as *condylomata lata*.

The cutaneous papillæ beneath the mucous patches react to the irritation and mixed infection by marked hypertrophy, resulting in the formation of low, cauliflower-like condylomata known as vegetating mucous patches or *venereal warts*.

Mucous patches within the rectum cause few symptoms, are generally not looked for, but probably occur more frequently than is supposed. Lang examined the rectum in 110 cases (forty-five men and sixty-five women) in the eruptive stage of syphilis, and found plaques or papules in sixteen. Most of them were situated on the posterior wall, some were on the sides, and in three cases the entire circumference was involved. Only three of these patients complained of pain, although most of the mucous patches were ulcerated. The stools of some cases contained blood and in one there was abundant mucopurulent discharge.

Syphilitic Ulceration of the Rectum.—This may occur within a period of eight or ten weeks of the initial lesion, or be a late manifestation. Ulcers appearing early are usually multiple, but a single ulcer may develop in the

chronic stage of the disease. The mucosa between the ulcers usually is quite normal in appearance. The typical syphilitic ulcer is punched out and craterlike with indurated margin and a leathery base which exudes a purulent, blood-streaked discharge of fetid, disgusting odor. In their early stages they rarely extend deeper than the submucosa, but chronic ulceration may cause extensive destruction of tissue, perirectal suppuration with formation of external fistulae or perforation into the vagina or, as in Mollière's case, into the peritoneum. In two of our cases, both men, in which the ulceration encroached upon the anus, purulent discharge dribbled almost constantly from the relaxed canal. The presacral lymph-nodes are enlarged, but must not be mistaken for gummata.

Treatment is systemic for the syphilis and local as for simple ulceration of the rectum. Where extensive chronic ulceration has caused wide destruction of tissue and production of much scar tissue, distortion of the parts and stricture result, due more to the secondary septic than to the specific infection. Antiluetic treatment has no effect on the fibrous tissue thus formed, but should always be instituted as a general measure until the Wassermann is negative.

Tertiary Lesions.—These are very rare in this region; only twenty-one instances among four thousand tertiary lesions in males and four hundred in females, according to Fournier; and commoner in women than in men. The chief tertiary anorectal lesions of syphilis are gummata, ulceration and anorectal syphiloma.

Gummata.—Gummata have been observed more frequently within the rectum than at the anus. Mollière and Verneuil have each reported instances of anal gummata. Sick, quoted by Quénu and Hartmann, in 11,826 females found only three gummata, one of the anus and two of the rectum. The author had in his care for several months a man, aged forty-eight, in whom an elastic swelling of lemon size extended from the anus into the ischiorectal fossa. He had been treated for syphilis many years before, the Wassermann was positive and the tumor regressed under antiluetic treatment. Graham has reported two similar cases, one occurring in a man, aged forty-seven, which was twenty-three years after the initial lesion; the other in a woman, aged twenty-eight, occurring three years after syphilitic infection. Bumstead and Taylor, Ball, and others have reported gummata within the rectum. In the case of a woman who had contracted syphilis five years previously, Tuttle removed from the rectum a smooth, globular nodule situated in the submucous tissue about 1 inch above the anal margin. The pathologist reported that the growth was typically gummatous.

Gummata of the rectum may be single or multiple. They may vary in size from a pea to an orange, and begin as round, elastic, painless deposits in the submucosa. By extension, they may later involve both the mucous and muscular coats of the bowel. They generally develop within five years after the primary infection, but Graham reported a case of perirectal gumma occurring in a man, aged forty-seven, who had chancre twenty-three years previously.

Andrews has defined a gumma as "a localized new formation of granulation tissue, occurring during the later stages of constitutional syphilis, vascular

in its early phases, but tending to early tissue death and caseation, with softening and, if superficial, ulceration."

The chief elements of the inflammatory mass are round and epithelioid cells with new-formed blood-vessels. The cells infiltrate and replace the normal tissues and, after attaining a certain size, gummata tend to undergo a sort of fatty degeneration due, in large measure, to the tumor compressing its surrounding nutrient blood-vessels. The gumma may (1) with treatment, be absorbed; (2) become an encapsulated, inert mass; or (3) by pressure necrosis perforate the mucosa and, becoming infected, result in an ulcer which, during the process of

healing, produces scar tissue that may cause stricture of the rectum. All the reported cases of gummata of the rectum which were diagnosed and treated before ulceration occurred, regressed without leaving a stricture.

Absence of pain is a characteristic of unulcerated gummata of the rectum, but when ulceration has occurred the symptoms are the same as in ulcer due to other causes.

A gumma occupying the ischiorectal fossa conveys to the examiner the impression of a cyst or deep abscess, although the signs of acute inflammation

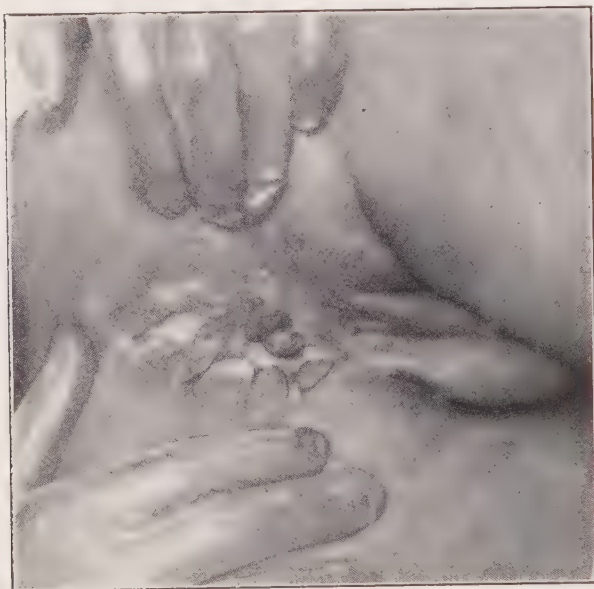


FIG. 230.—ANORECTAL SYPHILOMA.
Female, aged twenty-two years.

are lacking. If this mistake in diagnosis is made and the mass incised, bloody fluid escapes; infection of the wound may occur and fistula result.

Gumma of the rectum is to be differentiated from tuberculoma, and the tertiary ulcers from hyperplastic tuberculosis and ulcerated carcinoma.

Biopsy and a Wassermann test will usually clear up the diagnosis, although one should bear in mind the possibility of two or more diseases coexisting.

Diffuse gummatous infiltration of the rectum usually involves the terminal portion of the organ. The resulting deep ulcers are craterlike, with clean-cut edges and an indurated base. The adjacent rectal wall is thickened and inelastic, eventually leading to constriction of the lumen. These ulcers may perforate the rectal wall, resulting in various types of fistulae, or, becoming secondarily infected, may cause extensive destruction of tissue. In extensive ulceration there is a copious purulent discharge.

Associated with this type of ulceration, sometimes the perianal skin is hypertrophied, the unyielding fibrous folds obscuring the anus (anorectal syphiloma). In other cases, fleshy growths, developing upon an ulcerated base, radiate from the anus. These reddish, ragged excrescences, flattened between the buttocks, resemble a cockscomb, and Paget considered them as pathognostic of syphilis.

Treatment.—Systemic and local treatment of tertiary syphilis is practically the same as for the secondary phase of the disease, but with the addition of the iodids in full dosage.

In exceptional cases of extensive ulceration or stricture of the rectum, colostomy is indicated. This hastens healing and in a few cases bowel continuity may be restored, but generally the artificial opening must remain permanently. For abscess, fistula and constriction of the anus, appropriate surgical measures are necessary, together with systemic medication. Healing of the wounds is delayed, often indefinitely, unless antisiphilitic treatment is given.

Congenital Syphilis.—Anal lesions are among the earliest evidences of congenital syphilis. They usually appear from a few days to six months after birth, but Ball reported what appeared to be anorectal syphiloma in a child ten years old. At the onset the perianal skin is erythematous, and of characteristic copper color. Fissures and superficial ulcerations develop, with thin, seropurulent discharge. Under treatment the lesions do not extend into the anal canal and rectum. The inguinal lymph-nodes may be enlarged.

Other signs suggestive of a positive diagnosis of syphilis in children are failure of normal development, squamous lesions on the palms of the hands and soles of the feet, and Hutchinson's teeth. A positive Wassermann is, of course, conclusive.

Prognosis.—If the condition is recognized and treated during the first two or three months of life, it is believed that the majority of cases escape later manifestations of the disease. Naturally the prognosis is much better when the physician has the coöperation of intelligent parents than with the careless and ignorant, and in institutions.

REFERENCES

- BLOOMBERG, L. H., and BARENBERG, L. H. *Am. J. Dis. Child.*, Vol. 29, Feb., 1925.
 FOURNIER, A. *The Treatment and Prophylaxis of Syphilis*, New York, 1907.
 GRAHAM, A. B. *Tr. Am. Proctol. Soc.*, 1914.
 JONES, A. E. *J. Am. M. Ass.*, Vol. 88, May, 1927.
 JULIEN, L. *Bull. Acad. de méd., Par.*, 1907, Vol. 71.
 KINGSBURY, Jerome, and PECK, S. M. *J. Am. M. Ass.*, Dec. 4, 1926.
 LANG, E. *Pathologie u. Therapie des Syphilis*, Wiesbaden, 1884, Vol. I.
 MARTIN, E. G., and KALLET, H. L. *J. Am. M. Ass.*, Vol. 84, May 23, 1925.
 MCGLINN, John A. *Tr. Am. Gynec. Soc.*, 1926, p. 227.
 MOLLIÈRE, D. *Traité des Maladies du Rectum et de l'Anus*, Paris, 1877.
 TUTTLE, J. P. *The Anus, Rectum and Pelvic Colon*, New York, D. Appleton & Co., 1907.

CHAPTER XX

STRICTURE OF RECTUM AND PELVIC COLON

Stricture of the rectum is not a disease entity, but is the result of a congenital malformation, or of an infection, inflammation, irritation or trauma (either mechanical or surgical). Simple neoplasms within and external tumors may cause mechanical obstruction of the bowel, but in no sense do they constitute a stricture. Malignant growths, especially carcinomata, form a type of stricture which is both contracting and stenosing. This feature will be considered under the chapter on Carcinoma.

Spasmodic or Phantom Strictures.—Most authorities deny the occurrence of spasmodic or phantom strictures, while a few others have reported isolated instances. They are alleged to occur at the level of attachment of the levator muscles to the rectum and at the rectosigmoidal juncture. Failure to pass the sigmoidoscope into the sigmoid is, in my experience, due to (*a*) an anatomic condition, the acuteness of the angle at the rectosigmoidal juncture; (*b*) a pathologic condition, represented by constricting peritoneal bands and adhesions, and (*c*) is rarely attributable to spasm, the spasm being transient. No case of cicatricial stricture that I have examined was due to muscular spasm.

In form, strictures are annular, tubular or valvular. The latter refers especially to an inflammatory thickening and rigidity of a valve of Houston which is a rare occurrence. An annular stricture is narrow but involves the entire circumference of the bowel lumen, like a ring. A tubular stricture consists of a stenosis, 1 inch or more in length, involving the entire circumference and usually all the tunics of the rectum. The form and location of the stricture are significant for the treatment, and are dependent largely on the cause and extent of the inflammation, and the amount of tissue destruction and replacement by fibrous tissue.

ETIOLOGY

Broadly speaking, all strictures are congenital, traumatic or inflammatory. Apart from the congenital, the vast majority of strictures develop from the twenty-fifth to the fortieth years, and the incidence in the sexes is about equal.

Congenital Strictures

Congenital anomalies of the colon are rare and are usually associated with errors of development elsewhere in the body. The anomaly may take the form of an atresia, partial or complete, a segment or large portion of the colon being

absent or very narrow and having a small lumen. In other cases the colon may end in a blind pouch. Several cases of congenital stenosis have been reported, the constriction being tubular or diaphragmatic. Imperforate rectum may occur as the only anomaly, or its blind end may communicate with the bladder, urethra, uterus or vagina. Congenital atresia of the anus occurs most commonly at the level of fusion of the proctodeum and hind-gut, and is due to imperfect or incomplete absorption of the anal membrane. This corresponds in position to the pectinate line, or roughly the mucocutaneous junction. Imperforate anus may be associated with atresia of the colon but in the majority of cases is the sole anomaly. An anorectal defect of development occurs in approximately one in five thousand cases. Of forty-one personally collected cases, sixteen involved the rectum and twenty-five the anus. Of these, twenty-six were males, thirteen females, and in two the sex was not stated. An operation was performed on thirty-four, and thirty-one were successful. As a rule, congenital strictures are recognized early in life, and then methodical dilatation usually effects a cure. A partial membrane may persist requiring surgical removal, or ulceration may occur above it, causing a true fibrous stricture. Imperforations, unless very thin, and relieved at birth by an emergency operation, are prone to develop stricture subsequently.

Traumatic Stricture

Assigned causes of traumatic stricture of the rectum are pressure of the fetal head in prolonged labor, foreign bodies (enteroliths), unskilled instrumentation, and operations for hemorrhoids, fistula and resection of the rectum. Quite a number of cases of severe stricture have been reported as developing some time after prolonged labor. Their usual site is rather constant, about 2 inches above the anus, and suggests as causal, direct trauma from pressure, resulting in inflammation of the rectal wall, necrosis of the rectal mucosa, or pelvic cellulitis. In the cases the author has seen, the pressure resulted in the formation of a rectovaginal fistula, no rectal stricture occurring. Foreign bodies perforate the mucosa causing an abscess, and enteroliths may cause extensive ulceration; stricture has not resulted in the cases the author has treated, although, of course, it is possible. Injury of the bowel, by syringe tips or clumsy instrumentation, may be followed by infection and stricture, as was observed in one case. Caustic injections and superheated injections, with their inflammatory reactions, may result in cicatricial stenosis.

Stricture should never follow a properly performed hemorrhoidectomy. In the ligature or clamp and cautery operations, the tumors are removed in the axis of the bowel, leaving a strip of mucosa between the adjacent hemorrhoids. To insure a canal of normal caliber and to hasten the absorption of exudate, digital dilatation is begun on the seventh day and repeated twice weekly until healing is complete. Stricture may follow a Whitehead operation, especially if union is not primary. As this operation is now practically obsolete, stricture from this cause should be seen less often in the future. Incontinence rather

than stricture is to be feared after operation for fistula. Certain neglected cases of blind external and blind internal fistula may, however, form stenoses. In the latter, the only opening is between the anal sphincters. Tonicity of the sphincters impedes drainage; infiltration and connective tissue formation extend circularly around the intestine forming a stricture at the level of the internal sphincter. I have observed this in seven cases.

Resection of the rectum and end-to-end anastomosis is almost invariably followed by some degree of stenosis at the line of union. This is due chiefly to the absence of peritoneum, but also to interference with the blood supply and to infection. Gynecological operations, especially extensive procedures for malignant disease of the uterus and ovaries, may be followed by perirectal fibrosis, resulting in stenosis. The inflammatory reaction of the rectum to radium may result in its partial or complete occlusion.

Inflammatory Stricture

These comprise by far the largest group and they are of the greatest clinical importance. The infection of the bowels may be simple or specific. Usually so-called simple infections are by the colon bacilli, streptococci and staphylococci of various strains, leading to acute and chronic inflammation. Specific acute infections are amebic and bacillary dysentery, gonococcal and bilharzial disease; the chronic are tuberculosis and syphilis. Far from being simple, the so-called simple infections are obscure and complex. So long as the infection is confined to the mucosa, stricture does not occur. Destruction of large areas of mucosa as by caustics, or invasion of the submucosa through ulceration of the mucosa, is the most usual method of stricture formation. In bacillary dysentery the inflammatory process is usually limited to the mucosa and no stricture results. Amebic dysentery, at least in the temperate zones, at first attacks the mucosa of the distal colon. Correct early treatment usually eliminates the active infection promptly and the mucosa, viewed through the proctoscope, presents a normal appearance. Neglected chronic cases and the comparatively few which do not respond to specific therapy, show an atypical type of ulceration. The typical amebic ulcers have become secondarily infected by the normal intestinal flora and the gross appearance is that of chronic ulcerative colitis. It then may be definitely stated that amebiasis does not result in stricture unless a secondary infection occurs. In approximately 150 cases of amebic infection treated by the author, only one developed an annular, rectal stricture. This was in a young man who, following amebic infection, developed chronic ulcerative coloproctitis which persisted with remissions and exacerbations over a period of ten years. The stenosis, which would scarcely admit the little finger, was just above the anal canal. It is quite probable that in most of the reported cases of stricture occurring in amebiasis, the process was the same as in this instance.

These limited observations accord with the classic statistics of Woodward, who states that no cases of stricture, following dysenteric ulceration, were re-

ported during the Civil War, or have been since. Among the Federal troops there were 287,522 cases of dysentery, 28,451 being chronic. Deaths numbered 9,431, of which 3,855 occurred in chronic cases. Confirmatory of this is the fact that the large number of dysentery cases of the World War have, as yet, shown but few strictures. At the time of the Civil War, there was no check-up on the nature of the infection and, as Pennington observes, many of the cases of intestinal disturbance were probably due to improper and poorly cooked food rather than amebic or bacillary infection.

As a result of chronic inflammation, the entire rectum and even large segments of the colon develop thickened walls and a narrowed lumen but seldom an actual stricture. Exceptionally the distal 3 to 5 inches of the rectum undergo a fibrotic change. The lumen, not more than 1 to 2 centimeters in diameter, is lined with a pyogenic membrane. Discharge of pus and blood is a constant feature and symptoms of chronic partial obstruction are usually manifested. Of this type six have occurred in the author's practice.

Gonococcal infection of the rectum in adults usually limits itself to this segment, responds favorably to treatment, and in seven cases treated by the author, showed no tendency to chronic ulceration or stricture formation. Many European authorities, especially the German and the French, assign first place to gonococcal infection in stricture formation. The vaginal discharge is cited as the usual medium. In view of the large number of cases of gonorrhea in women and the comparative rarity of gonococcal proctitis or rectal stricture in females, clinical experience does not justify the contention of these authorities. In infants and children suffering from gonorrheal vaginitis, the incidence of rectal infection varies markedly in different series of cases, but in general it is a rare complication. Thus, Holt had 233 cases, no proctitis; Pollock 189 cases, seven proctitis; E. R. Spaulding, 74 cases, six proctitis. After a careful study of over five thousand cases of gonorrheal vaginitis, in outpatients from twelve days to twelve years of age, B. Wallace Hamilton doubts "if a half dozen were encountered who had sufficient clinical evidence to warrant such complication" (personal communication). On the other hand, in institutions for children, rectal infection has at times been almost epidemic. J. E. Valentine reported sixty-one in 161 cases, and Bloomberg and Barenberg observed gonococcal proctitis in forty-one infants under two years, all originating in the same institution. Thirty-seven of these wore diapers. In active vaginitis the diaper keeps the discharge in contact with the anus and favors its infection. Bloody stools were the striking sign. The mucosa of the distal 3 or 4 inches of the rectum was congested and in some cases ulcers 1 centimeter in diameter penetrated to the muscularis. As infection produces serious pathologic ulceration, early diagnosis and treatment are necessary to prevent marked destruction of tissue and possibly later stricture.

Chronic Specific Infections.—These are tuberculosis and syphilis.

Tuberculosis.—It is generally conceded that, in adults, tuberculosis of the intestine clinically is practically always secondary to a pulmonary lesion, either active or quiescent. Tuberculosis tends to produce stricture of the small intes-

tine, often multiple, and in the region of the cecum rather than in the terminal colon. Thus in seventy cases, fifty were in the right colon, six in the appendix, four in transverse colon, and one in rectum (Braun-Wortman). The comparatively frequent occurrence of intestinal tuberculosis without stricture formation is noteworthy. Just why this should be so is not settled, but it seems to depend



FIG. 231.—RECTUM ALMOST OBLITERATED BY SYPHILITIC STRICTURE, RETAINS NO BARIUM. Colored woman, aged thirty-three years.

on two factors: (*a*) The way the tissues react to the tuberculous infection, and (*b*) the character and amount of secondary infection present. If the natural resistance of the host is feeble, secondary infection predominates, and the inflammatory process is likely to be destructive. On the contrary, if the host possesses strong natural resistance, the process is more apt to be productive, with the formation of cicatricial tissue and stenosis. Extension is through the lymphatics and circularly around the bowel.

Hyperplastic tuberculosis occasionally develops in the rectum and pelvic colon in the form of a circumscribed tumor, a tuberculoma. Regional lymph glands

are involved and enmassed in the tumor. Extensive infiltration may lead to a high-grade stenosis. Macroscopically, tuberculoma cannot be differentiated from carcinoma, but discovery of scattered tubercles in microscopic sections is decisive. The writer saw a tuberculoma of the rectum in a patient of J. P. Tuttle. He excised the rectum for a growth which, clinically, closely resembled a



FIG. 232.—INFLAMMATORY STRICTURE OF RECTUM, 4 INCHES IN LENGTH, TREATED BY DILATATION.
Female, aged thirty-six years.

carcinoma. Histologically the tumor was a tuberculoma. However, an excellent result was obtained and excision was the correct procedure.

Syphilis.—Professional opinion is not in accord as to the part played by syphilis in the production of stricture. The older writers assigned it a prominent place in the etiology. In my series of over one hundred cases, 80 per cent had a definite luetic history or the blood Wassermann was positive at the time of examination. Neither the fact that the patient has had syphilis, nor that the

Wassermann test is positive, nor that specific treatment does not affect the lesion, proves anything for or against the syphilitic nature of the stricture. However, these observations are suggestive and, the author believes, very significant. A considerable proportion of such cases occurred in colored patients at the clinic.

Balloch, in 1895, and Matas, in 1896, observed that certain fibrous tissue processes were peculiar to dark-skinned races, notably keloid, elephantiasis and uterine fibroids. Recently Rosser suggested the term "fibroplastic diathesis" to call attention to the element of racial heredity, and "to decide a process characterized by mesoblastic hyperplasia, without direct involvement of surrounding tissues, in response to injury." Comparative observations were made by Rosser on 1,138 rectal cases of which 104 were negroes, in Baylor Hospital, Houston, Texas. Stricture of the rectum was observed in thirty-six cases, nineteen in negroes, and seventeen in white persons. The relative incidence in negroes to white persons was eleven to one. Analysis of this series of cases indicates that rectal disease is equally prevalent in the negro and the Caucasian races; that cancer, hemorrhoids, pruritus, fissure, and spastic sphincter are less common in the negro, but that inflammatory conditions, rectal ulcer, abscess, fistula and stricture, are definitely more prevalent in the negro.

Syphilis, in the tertiary stage, may properly be regarded as one of the most common infections laying the foundation for stricture. Gummata and obliterating endarteritis and, according to Rieder, a proliferation of the intima of the rectal veins even to their obliteration, are responsible for the ulcer. If the ulcer is not healed, there is a rapid production of connective tissue, and the basis of a stricture is established. Quénu and Hartmann explain on anatomic grounds why luetic strictures occur more often in women than in men, two to one in the author's series. The lowest group of rectal veins anastomose directly with branches of the external pudendal, and the latter originate in the posterior commissure of the vulva, the chief seat of syphilitic infection.

PATHOLOGY

Whatever the nature of the infection, the steps in the formation of inflammatory stricture seems to be much the same, namely:

1. Infection and inflammatory process.
2. Ulceration of the mucosa.
3. Round-cell infiltration and production of connective tissue, which tends to encircle the bowel.
4. Persistent contraction of the new formed fibrous tissue.
5. Compression and atrophy of the muscle coat of the bowel.

In a word, the formation of inflammatory stricture depends on an extensive production of connective tissue in the mucosa or deeper tunics of the bowel which persistently contracts. The entire wall of the bowel involved in the stric-

ture is infiltrated several centimeters in depth. Finally the infiltration extends to the perirectal tissues and the affected segment is transformed into a firm, fixed canal. Not infrequently perirectal abscesses form, which perforate into the vagina (most frequently), or bladder, resulting in obstinate fistulæ.

When the stricture becomes obstructive, pressure of hard, retained feces causes indurated ulceration of the mucosa immediately above the constriction. In cases of long standing, remnants of the mucosa may form small excrescences or elongated polyps in this situation. The bowel above the stricture is usually dilated and hypertrophied, sometimes infiltrated over a wide area. Ulceration, below fibrous strictures, is probably due to interference with the blood supply. Compression of the vessels limits the arterial flow, and obstructs the venous return. Consequently the natural tendency of the ulcers to heal is weakened, and their response to heal is weakened, and their repaired. Infection through these ulcers results in abscesses and fistulæ opening through the perianal skin. Hemorrhoids and condylomata are frequent concomitant pathologic processes.



FIG. 233.—BOUGIE ARRESTED IN SULCUS SURROUNDING A STRICTURE.

Histologically the membrane lining the stricture may be ulcerated and usually is in the long tubular strictures, but in other cases the smooth lining usually shows replacement of the normal cylindrical epithelium by squamous cells.

SYMPTOMS

A history of progressive constipation, futile straining at stool, and frequent fetid passages of pus and blood is characteristic. Rectal prolapse is sometimes induced when the stricture is some distance above the anal canal. Patients state that they obtain the greatest relief by taking saline cathartics which produce liquid stools. Ribbonlike stools are of no special significance, but naturally the passage is of small caliber when the anus is constricted or when the stricture at a higher level is forced down to the outlet during the act of defecation. When the stricture has a small lumen or is tubular, attacks of almost complete bowel obstruction are common. Abdominal distention, anorexia and nausea are present. Fecal accumulation above the stricture gives rise to intestinal toxemia. Ultimately, in unrelieved cases, the health is undermined. Loss of weight and strength are progressive and a secondary anemia develops.

DIAGNOSIS

By local examination a stenosis of the bowel is easily recognized. It is important, however, not only to discover the stricture but also to determine its

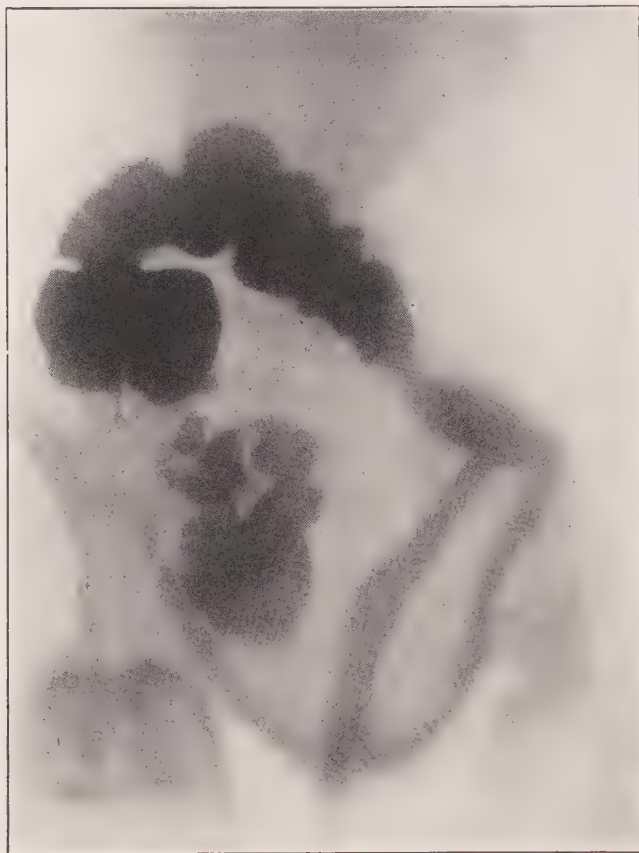


FIG. 234.—BOUGIE INSERTED THROUGH LONG, INFLAMMATORY RECTAL STRICTURE.

Second stricture in transverse colon. Confirmed at laparotomy. White female, aged thirty-seven. Wassermann 4 plus.

nature, size, form and length, and the degree of infiltration and extent of ulceration above and below it. Over 90 per cent of strictures are within the palpable area—the lower 4 inches of the rectum. In eighty of the author's cases, the situation of the lower limit of the stricture was: Anal canal, twenty-six; within 5 centimeters, twenty-nine; between 6 and 10 centimeters, sixteen; over 10 centimeters, nine.

Congenital and traumatic (including operative) strictures present few difficulties in diagnosis. They are usually annular and ulceration is limited or absent. Inflammatory strictures, however, must be differentiated from carcinoma. Carcinoma usually begins abruptly

ly and has a sulcus below it. The growth itself is ulcerated and characteristically feels irregular, hard and nodular. The approach to an inflammatory stenosis is usually a gradual, conelike, firm contraction. The mucosa below, when ulcerated, feels granular. In women, a vaginal examination should always be made. Palpation through the posterior vaginal wall will frequently show the length of a fibrous stricture. Displacement of the uterus, diseased adnexa and pelvic

growths may account for rectal stricture of extrinsic origin. After digital palpation, the graduated proctoscope of author's model, $\frac{1}{2}$ inch in diameter and 10 inches long, is introduced. Through this the examiner can note the ulceration below, discover strictures beyond the reach of the finger, pass the tube through the lumen in nearly all cases, and thus determine their length and see the extent of any ulceration above. When malignancy or tuberculosis is suspected, by using a tube of larger caliber, the biopsy forceps can be introduced and tissue secured for histologic examination. Scrapings may also be taken from the ulcerated surface for examination for tubercle bacilli. Examination of the pus from the ulcerated area for tubercle bacilli is useless for they are seldom found in the discharge even when the process is tuberculous. Proctosigmoidoscopy further clears up the diagnosis in cases of external compression, a number of which have been treated over long periods for stricture. Finally, roentgenograms are made twenty-four hours after a barium meal and also after a barium clysm. They (*a*) outline the stricture, (*b*) demonstrate others at a higher level, a rare occurrence but one to be anticipated, and (*c*) show the length of sigmoid available in case of operation. Mrs. S., white, aged thirty-seven, had a long tubular stricture of the rectum causing obstruction for which colostomy was done in the sigmoid. One year later obstruction developed above the colostomy and an x-ray plate showed a stricture in the transverse colon, illustrated in Figure 234. Under local anesthesia, the author performed an ileostomy near the cecum. The patient gained 25 pounds in weight, and for several years has been in good health. As soon as the x-rays are taken 1 ounce of castor oil is given to expel the barium.

A Wassermann test of the blood should be made in every case of stricture. In my series the test was positive in 86 per cent of the cases clinically of the type usually classified as syphilitic in origin. The tuberculin reaction is positive so often in adults that little or no reliance can be placed on it for diagnosis.

PROGNOSIS

This varies with the nature of the stricture and the treatment instituted. For congenital and traumatic strictures, the prognosis, with treatment, is comparatively good. For inflammatory strictures, the tuberculous excepted, constant care and good management will usually insure a life of comparative comfort in the majority of cases; in a few an operative cure can be effected. If neglected, abscess, fistula, obstruction and toxemia lead to a fatal issue.

TREATMENT

Treatment is preventive, palliative and operative.

Preventive Treatment

Almost all strictures following operations on hemorrhoids and fistulæ could be prevented by proper surgical technic and suitable postoperative care, as indi-

cated under Etiology. It was noted under Pathology that an ulcer is the usual initial gross lesion in inflammatory stricture. Most ulcers in their early stages respond favorably to local and constitutional treatment, healing with a scar limited to the mucosa, or mucosa and submucosa, and no marked narrowing of the bowel lumen results. Thus the greatest measure of prevention is to heal the ulcer in the prestricture stage. Unfortunately this is not often possible, as the development of stricture is insidious and patients usually do not apply for treatment until the stenosis is far advanced.

Treatment after Development of Stricture

Palliative Treatment.—In the majority of advanced cases of stricture, the patients are debilitated and underweight and general measures to build up the constitution should be adopted. The diet should be liberal and nutritious, excluding only fermentative articles. Liquid petrolatum in $\frac{1}{2}$ ounce doses two or three times daily favors easy bowel action. When the Wassermann blood-test is positive, arsphenamin should be administered until the blood reaction is negative, if this can be accomplished without producing arsenical poisoning, and should be followed or alternated by mercury given by needle, and the iodids. Specific treatment does not affect the cicatricial tissue already formed, but is employed as a constitutional measure.

Dilatation.—The objective is dilatation of the stricture and healing the ulceration by irrigations and topical applications. Dilatation has a very important place in the management of stricture. In many cases, patients can by this means be carried along very comfortably without operation. After proctotomy, dilatation is always employed to maintain the patency. Forcible dilatation by metal instruments or hydrostatic pressure is so likely to rupture the bowel that they should never be used. Exceptionally one experienced in the treatment of rectal strictures may use a metal dilator at the beginning when the constriction is situated low and its lumen is very narrow. I have found the male urethral sounds in graduated sizes very useful for this purpose. The greatest gentleness must be taken in dilating a rectal stricture. An accidental rupture of the bowel at the site of constriction may result in a perirectal abscess and septicemia. Mummery warns against this danger and states that he knows of four cases ending fatally. In two cases the patients themselves were responsible and in two others the accident followed attempts of medical men to dilate a difficult stricture. The safest and best instruments for general use in dilatation are the soft rubber Wales bougies in graduated sizes. Beginning with the largest that can be introduced comfortably, bougies are passed semiweekly in increasing sizes until a No. 7, at least, can be retained for ten or fifteen minutes. The increase in size is gradual, an advance of not over one or two numbers being made at a sitting. Maintenance of a bowel lumen of $\frac{3}{4}$ to 1 inch diameter meets all functional requirements. The discomfort and reaction attendant upon the introduction of Wales bougies larger than Nos. 7 or 8 have no compensa-

tory benefit. The position of the patient is left lateral. No anesthetic is used, but a hypodermic of morphin may be given one-half hour before treatment if deemed necessary. The bowel should be cleansed, if possible, by an antiseptic irrigation before the treatment. The bougies are coated freely with vaselin before introduction. A long tampon of cotton smeared with ichthyol ointment or saturated with 4 per cent argyrol solution and left *in situ* after dilatation has seemed to be of value. The bowel is irrigated daily with a solution of 2 per cent peroxid of hydrogen or 1:5,000 potassium permanganate. After dilatation has been accomplished, the patient is given a bougie of proper size and instructed how to pass it. While dilatation may be said never to cure a fibrous or cicatricial stricture, it will enable many of its victims to lead a life of comfort and health, handicapped only by the little extra time required for the treatment.

What has been said of dilatation refers to strictures located in the rectum, and within 10 centimeters of the anus, which comprises the vast majority. Because of the pain and trauma produced by dilatation, strictures of the anal canal are usually treated more simply by operation. High-lying strictures, that is, those situated above the peritoneal reflection, are to be dilated with the greatest caution. Accidental splitting of the stricture with rupture or perforation into the peritoneal cavity may quickly end in a fatal peritonitis. It is probable that perforation has occurred more frequently than the literature indicates, especially when instruments are passed while the patient is under anesthesia. The sensation of the patient warns of the amount of traumatism, and if this be abolished by anesthesia, one may perforate the intestine unconsciously. Wiener had personal knowledge of three cases of perforation of the rectum due to the passage of instruments under anesthesia. The accidents occurred in the hands of three different competent surgeons; in each case the injury was recognized at once and the abdomen opened for its repair. Recovery was prompt in one case; the second only after a prolonged wound infection, and the third died as the result of a perforative peritonitis.

The safest way to dilate a high-lying stricture is to introduce the bougie into the stricture through a proctoscope passed to the lower margin of the constriction. Dilatation up to the size of a No. 4 or 5 Wales bougie is about as much as should be attempted. A lumen of this size is fairly satisfactory in these cases which fortunately are comparatively few. In the case of a man, aged sixty-three, having a tight inflammatory stricture 2 inches in length situated 5 inches above the anus, Wiener opened the abdomen and "milked" the sigmoid over a small Wales bougie, held by an assistant against the lower opening of the stricture. Larger bougies were passed in the same manner, the last being left *in situ* eighteen hours. Four months later a large Wales bougie was passed per anum without difficulty and bowel action was without undue effort.

Carbon Dioxide Snow.—Clemons of Los Angeles has suggested this novel treatment for rectal stricture. As a prerequisite, all active processes, *i.e.*, ulceration, should be healed, if possible, so that one is dealing only with the fibrous tissue of the stricture. The objective sought is to change the stricture from a

hard resisting to a soft yielding state. "Edema will produce this desired result, as it causes each cell of the fibrosed area to become distended and subsequently to liberate a serous exudate after which the parts remain soft and boggy." This can be accomplished by using carbon dioxide snow. Its temperature is 109° F. below freezing, and is made by liberating the compressed gas into a chamois sack. Sloughing would result from direct contact of the snow with the body, and a proctitis, if the escaping gas came in contact with the rectal mucosa. To avoid this, the snow is packed into a rubber-tissue finger cot, the open end of which is tied over a retaining catheter, thus preventing direct contact and providing an exit for the gas. The catheter passed through the lumen of a rubber hose, whose diameter is that of the obturator of a proctoscope, is the means of making pressure with the encased snow against the strictured area. Cots filled with snow are inserted at fifteen minute intervals for one hour. About thirty-six hours after the treatment a serous exudate appears which abates within four days. One week later the stricture is dilated and the treatment repeated, now placing the cots within the lumen of the strictured gut, or at the upper margin of the stricture. No bougies are passed or other after care given, but the patient should report at intervals for observation. The procedure is painless and there are no untoward effects. Clemons states that the stricture does not tend to recur, but rather to become more pliable owing to the dilatation produced by the fecal passages.

At the Los Angeles meeting of the American Proctologic Society in 1923, Clemons showed a number of treated cases and the author had the privilege of examining them. The functional result and local condition were satisfactory, although considerable evidence of the stricture remained. In a number of cases in which we employed the carbon dioxide snow the results were less satisfactory, probably due to the fact that ulceration was present. The prerequisite of healing the ulceration—usually a very difficult thing to accomplish—before beginning the treatment, naturally limits the applicability of the method.

Electrical Treatment.—Picard reports excellent results in the treatment of stricture of the rectum by diathermy. The basis of the treatment was the observation that scar tissue may be "revitalized" by heat, and diathermy is the only method that generates sufficient heat in the tissues. The bloodless, hard, inelastic tissue is changed into one with good blood supply, which becomes soft and elastic.

The *technic* is simple and without danger. The active electrode is a Hégar bougie, caliber just sufficient to pass into the stricture without pain, and larger bougies are used as the lumen enlarges. The indifferent electrode is twin disks of block tin applied to the lumbar and abdominal regions. By using two electrodes on the skin and by varying their size, the intensity of heat in the strictured area can be kept averaging 45° to 47° C. with greater accuracy. A current of 1 ampere was employed for an exposure lasting from fifteen to twenty minutes. Treatments were given daily over an average period of four to six weeks, depending on the severity of the condition. Beneficial results of treatment were

recession of obstructive symptoms, formed stools, and increase in size of lumen (softening of tissues to be controlled by digital examination). In a period of three years, twelve cases of rectal stricture were treated with slight recurrence in two cases, which were readily controlled. The treatment was abandoned in two other cases: In one, a stricture following resection for carcinoma, complicated by multiple fistulæ; the other, a luetic stricture with uncontrollable symptoms of ileus in which colostomy was indicated and done. Strictures following the Whitehead operation should be treated surgically.

Bensaude and Marchand, using the same technic, employed a current of 3 amperes for twenty to thirty minutes three times weekly for two weeks; rest for a fortnight, then continued with larger bougies. Twenty or more séances were required for each case and the treatment was continued a certain time after the largest dilator could be introduced freely. Due to congestion, hemorrhage occurred in some instances after the early exposures. This may have been caused by using a current of too great amperage. They report five cases of inflammatory stricture treated by diathermy. A caliber of 28 to 29 millimeters was attained in the strictured area. Observations on these cases from three to eleven months after stopping treatment showed a recontraction of 4 to 5 millimeters, some ulceration and purulent discharge, but a lumen adequate for bowel function. These favorable reports should encourage others in the trial of diathermy in suitable cases of stricture.

Surgical Treatment.—This includes proctotomy, colostomy and excision.

Stricture of the anal canal is usually due to a cicatrix following an operation and is accompanied by little or no ulceration or discharge. Anesthesia is by local infiltration of 1 per cent novocain solution, as for a fissure operation. The scar tissue is divided completely by a tenotomy knife which passes along the palmar surface of the finger through the stricture. An incision is made posterior, then a similar incision on each side. In the absence of ulceration the longitudinal wounds may be sutured transversely. Wales bougies up to 1 inch diameter or the finger should be passed every other day for a month and then at longer intervals. Cure is to be expected.

Internal Proctotomy.—Mummery highly recommends this operation for strictures within easy reach of the finger and of the diaphragmatic type and some cases of the tunnel type, provided that the total length of the stricture is not more than 2 centimeters.

PROCEDURE.—Under general anesthesia and in the lithotomy position the bowel is irrigated with an antiseptic solution till thoroughly cleansed. With the index finger as a guide, a blunt-pointed straight bistoury is passed through the stricture. An incision is made posterior, then a parallel incision on each side. The incisions are niches rather than deep cuts, their depth depending upon the yielding of the dense fibrous tissue as determined by the palpating finger. Bougies or metal dilators are then passed until the lumen at the strictured area is of desired size, approximately $1\frac{1}{8}$ inches. The bowel is thoroughly irrigated with hot antiseptic solution, sponged dry, a generous amount of vaselin

injected and a vulcanite tube, corresponding in size to the largest bougie, passed, is inserted well above the stricture. The tube is removed in forty-eight hours and dilators passed daily for two or three weeks and then at longer intervals till there is no sign of contraction. Dilatation is continued for six months to a year. Thereafter periodical examinations should be made to detect any signs of recurrence.

For thin diaphragmatic strictures of the rectum, a simple and frequently effective procedure, is to apply through a proctoscope the spring valve-clip of Pennington. The clip embraces the margin of the stricture and by pressure necrosis cuts through the tissues in a few days.



FIG. 235.—KELSEY'S PROCTOTOMY KNIFE.

Linear or Complete Proctotomy.—Fibrous strictures are usually situated near the anal strait, and are accompanied by extensive ulceration and suppuration, requiring the free drainage that complete proctotomy affords. The operation is performed under general anesthesia and in the lithotomy position. Beginning in the mucosa 1 or 2 centimeters above the stricture, the stricture, both sphincters and all intervening tissues are divided by a clean incision carried back to the tip of the coccyx. Bleeding is controlled by superimposed strips of dry gauze packed firmly into the wound, and a rubber tube of $\frac{1}{2}$ inch diameter is passed into the rectum beyond the incision. The bowels are confined four days and thereafter irrigated daily. The wound is treated as the wound of a fistula and bougies are passed to prevent recurrence. A theoretical objection to this operation is possible incontinence. In the author's experience in several cases and in the hands of colleagues, complete incontinence has not resulted after the wound has healed—a period of several weeks. While linear proctotomy usually does not cure an inflammatory stricture, it is a perfectly safe procedure that any surgeon can execute quickly, it gives immediate relief, and is a most beneficent operation.

External Proctotomy.—After removal of the coccyx through a median skin incision, the stricture is divided by a posterior longitudinal incision, supplemented by passage of bougies. At present this operation is seldom done, objections being danger of fistula at site of incision, slow healing of the wound, and permanent local weakness.

Excision and Resection of the Rectum.—These severe operations are rarely indicated for stricture of the rectum, and very few cases are suitable for radical extirpation. The theoretical appeal for excision is nullified by its risks and poor results. The mortality is stated to be about 12 per cent. Extension of fibrosis to the perirectal tissues renders dissection more difficult than for carcinoma, and increases hemorrhage. Resection could be done only when the stricture is more than 1 inch above the anus. The technic is similar to a Kraske resection of

the rectum for carcinoma: Excision of coccyx, resection of strictured area, and end-to-end anastomosis. Recurrence of stricture at the site of suture is almost invariably to be expected.

In exceptional cases, a perineal amputation of the rectum may be performed according to the modified technic of Quénu and Tuttle, for perineal extirpation of the rectum for carcinoma. Colostomy, some time prior to the operation, favors its success. Meanwhile active infection has subsided, complicating abscesses and fistulæ have healed and the patient's general condition has improved.

Case.—Mrs. B., aged thirty-one, consulted me in 1909 for constipation and rectal discharge of ten years' standing. She had had syphilis. Forcible dilatation under ether had been done seven and four years previously, and bougies passed at irregular intervals. A fibrous stricture began just above the anal canal, admitting only a 13 F. urethral catheter. Vaginal examination indicated that the stricture was about 2 inches in length. I did a perineal extirpation, removing 5 inches of the rectum (Fig. 236). The patient was well ten years later, had gained 24 pounds in weight, and had one or two formed stools daily, with excellent control.

Colostomy.—This is either temporary or permanent, and is usually made in the pelvic colon, but if this is diseased or its mesentery too short, the stoma is made with advantage in the transverse colon.

Temporary colostomy, by deflecting the fecal current, relieves obstruction and toxemia, prevents constant irritation and infection of the strictured area, permits treatment of the stricture by irrigation and dilatation under favorable conditions, and favors healing of the ulceration. It is indicated, especially, when extensive ulceration is associated with the stricture and for the relief of complete obstruction at the site of contraction. After healing is complete and a functionally adequate lumen has been established, the colostomy may be closed.

Permanent colostomy is indicated for narrow fibrous strictures of the tubular type. These may involve as much as 3 to 5 inches of the bowel, or the entire rectum, practically constituting a "fibrosis of the rectum." It is difficult to per-

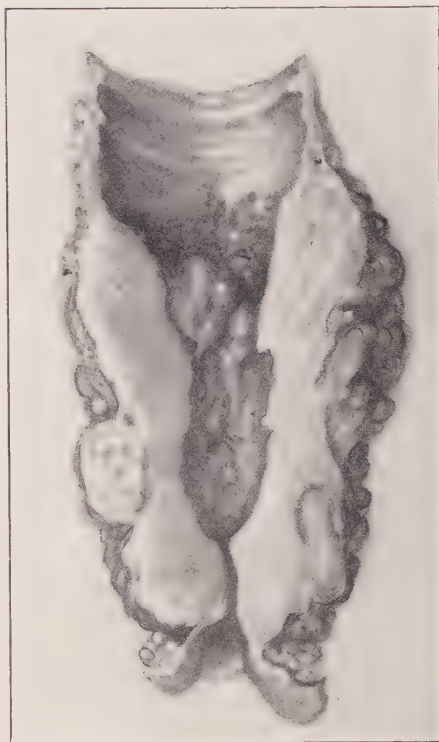


FIG. 236.—STRICTURE OF RECTUM, PERINEAL EXCISION.

Female, aged thirty-one. Result excellent ten years after operation.

FIFTY CASES OF STRICTURE OF THE RECTUM (YEOMANS)

Classification	No. of Cases	Average Age	Sex		Race		Wassermann			Location			Form			Treatment			Result				
			Male	Female	White	Colored	Positive	Negative	Not Taken	Anal Canal	Within 5 Cm.	Within 6 to 10 Cm.	Over 10 Cm.	Valvular	Annular	Tubular	Dilatation	Proctotomy or Incision		Colostomy	Excision		
Congenital	4	25 mos.	4	..	4	..	..	1	3	4	..	..	..	..	..	2 imp.	2 imp. 1 cured	..	..	Died	3	1
Traumatic and operative	9	37 yrs.	5	4	9	..	..	4	5	8	..	..	1	..	..	5 3 imp. cured 2 cured	3	..	..	..	3	5
Following fistulas...	7	38 yrs.	5	2	7	..	..	6	1	4	..	2	1	1	6	..	1 imp. 2 cured	3	..	..	2	2
Inflammatory: (a) Simple infection (?)	1	58 yrs.	1	..	1	..	..	1	..	..	..	1	..	1	..	..	..	1 imp.	..	..	1	..
(b) Tuberculous.	3	43 yrs.	2	1	3	..	..	2	1	1	..	2	..	..	2	1	..	..	1 lived 3 yrs.	..	1	..
(c) Syphilitic ...	24	34 yrs.	8	16	16	8	18	3	3	..	16	7	1	..	8	16	13 12 imp. 1 cured	5 imp. 2 cured	1 imp. cured	..	19	2	
Perirectal	2	40 yrs.	..	2	2	..	..	2	..	..	1	1	..	..	2	..	1 imp.	..	..	..	1	..
TOTAL	50	25	25	42	8	18	19	13	17	17	13	3	2	18	17	22	14	3	1	1	29	10

suade patients to accept colostomy, but after the artificial anus is established, they appreciate the local and general benefits derived from it and are most grateful.

Recurrence after Operation.—Of fifty-five cases reported by Graham, twenty-two had previously been operated upon from one to five times.

In forty cases treated and observed by myself over a long period, one tuberculous, died in three years; the condition in twenty-nine was improved, that is the patients maintained comfortable health; and ten, of which two were syphilitics, were cured.

STRICTURE OF THE SIGMOID COLON

Non-malignant stricture of the sigmoid colon is a rare condition in comparison to its frequency in the rectum. In the colon proper, the sigmoid is the most common site of stricture.

Intestinal diverticula (diverticulosis) occur most frequently in the sigmoid colon and when inflamed (diverticulitis, peridiverticulitis) are one of the most common causes of non-malignant stricture in this situation.

Hyperplastic tuberculosis and infiltration about tuberculous ulcers may result in stricture of the sigmoid. In the six cases of hyperplastic tuberculosis reported by Erdman, one involved the ileum alone, one ileum and cecum, two cecum and ascending colon, one cecum and rectum, one pelvic colon. Definite signs of pulmonary tuberculosis were present in four cases, but the lung lesion was not very active in any. The pelvic colon case occurred in a man of twenty-nine, complaining of constipation, hemorrhoids and bloody stools of four months duration. X-ray after a barium enema showed a filling defect suggestive of a neoplasm. At operation, 4 inches of the distal loop of the pelvic colon were found to be congested and thickened in its entire circumference, the lumen slightly encroached upon and adjacent lymph-nodes enlarged. Eighteen months after resection the patient was in good health and had gained 20 pounds. This series shows the likelihood of more than one intestinal segment being involved in hyperplastic tuberculosis and the frequent, probably primary, focus in the lungs.

Simple fibrous stricture of the sigmoid is rare indeed and, as a rule, would be the result of a chronic ulceration, extending beyond the mucosa. Schloffer's experimental and clinical investigations indicate that stricture may develop from two to twelve months after blunt violence to the abdominal wall as a blow with the fist, a kick, being run over by a vehicle, etc. Injury to the mesentery may so interfere with the circulation that necrosis of the mucosa occurs. Necrosis of the entire wall may occur, protecting adhesions preventing perforation, but later a stricture supervenes.

Symptoms.—The usual symptoms are progressive constipation, sometimes alternating with diarrhea, occasionally blood in the dejecta; recurrent attacks of abdominal pain, and cramp at stool; abdominal distention and gurgling and,

if obstruction supervenes, visible peristalsis. Emaciation and weakness are usually marked in chronic cases.

Diagnosis.—In many of the cases due to diverticulitis and tuberculosis the sigmoid colon may be felt distinctly thickened through the abdominal wall. Rectal palpation may reveal only a ballooned rectum. As Thomas Bryant



FIG. 237.—INFLAMMATORY STRICTURE OF RECTUM AND SIGMOID. Wassermann positive. Colostomy. White woman, aged forty-two.

of London, observed long ago, “ballooning” of the rectum is a characteristic feature of a slowly-formed stricture of the upper rectum or pelvic colon. Sigmoidoscopy is a valuable aid in the diagnosis. Unless the sigmoid loop is fixed by adhesions a tube of $\frac{5}{8}$ inch diameter and 13 inches long can be passed to its apex. If a stricture is discovered, and its nature is doubtful a small section of tissue may be taken for microscopic examination by the biopsy forceps passed through the tube.

Examination by the x-rays should be used in every case that is not completely obstructed. They demonstrate the site and extent of the stricture, but



FIG. 238.—INFLAMMATORY STRICTURE OF SIGMOID.
Male, aged thirty-seven years.

frequently the nature of the lesion cannot be thus differentiated from carcinoma. Discovery of a tuberculous lung lesion by radiograms of the chest may throw light on the nature of the stricture. The author had two cases of tubular cicatricial stricture of fairly large caliber.

Case I.—G. S., male, aged forty, for two years had pain in the loins and

right hip, stools with straining three times a day containing some blood, and increasing weakness. The proctoscope of $\frac{1}{2}$ inch caliber met the stricture 5 inches above the anus and just passed through it. The stricture was $3\frac{1}{2}$ inches in length as was confirmed by an x-ray. There was no history of dysentery or syphilis and the Wassermann was negative.

Case II.—H. A., male, aged thirty-seven, Spanish-American, had a chancre ten years earlier, and was operated upon for prolapse of rectum five years ago.

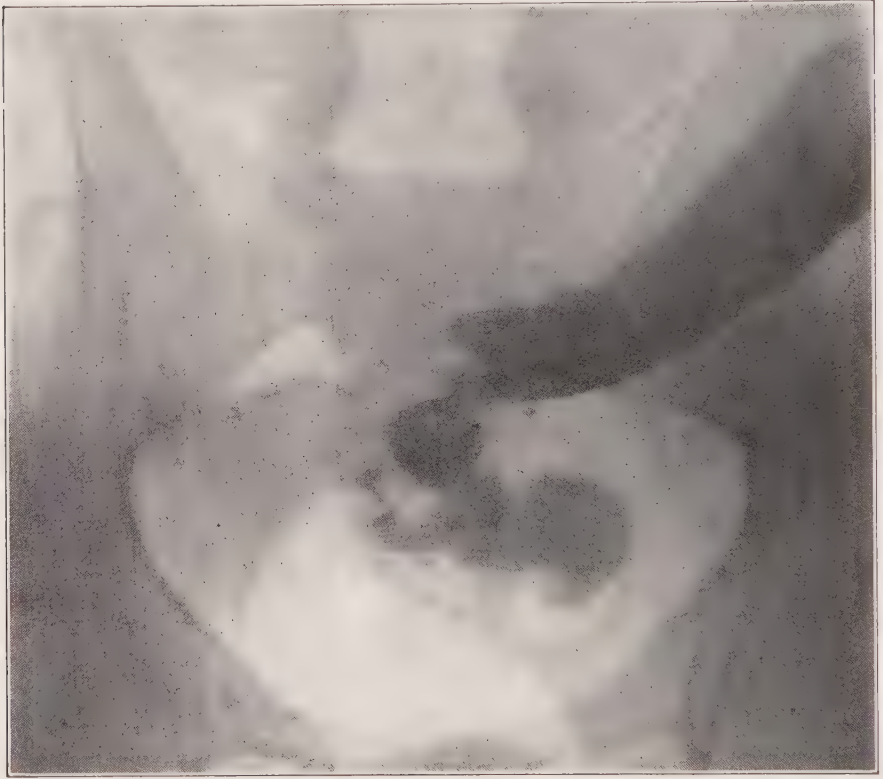


FIG. 239.—ANNULAR STRICTURE OF LOWER SIGMOID.

Six years after resection of pelvic colon and end-to-end anastomosis for chronic diverticulitis. Male, aged 56 years.

For nine years he had progressive constipation and blood in the stools. There was a weight loss of 10 pounds and pains irregularly in the back and abdomen. The finger felt, in the upper rectum, longitudinal ridges of induration, which were seen through the proctoscope to be ulcerated. The proctoscope of $\frac{1}{2}$ inch diameter showed the face of the stricture to be white and fibrous. With difficulty, the tube with obturator in place, was passed through the stenosed segment, a distance of 3 inches, where the constriction opened abruptly into a lumen of full size with a mucosa apparently normal. Roentgenologic report by Quimby: "Colon dilated down to lower end of sigmoid where there is a marked constriction, tapering from upper sigmoid downward, continuing in a narrow

channel, then dilating at the upper end of the rectum. The contour of the constricted portion is uniform. Diagnosis: Organic stricture of the sigmoid." (See Fig. 238.)

The surface of the stricture was ulcerated in each case.

Annular cicatricial stricture of the rectum, following resection of the bowel and end-to-end anastomosis above the peritoneal reflection, is of interest. An example of this is recorded in the chapter on Diverticulitis. (See Fig. 239.)

Treatment.—For strictures that can be reached by the proctoscope very gentle dilatation by bougies passed through the tube will often afford considerable relief. Experience may show that diathermy applied in the same way may be beneficial. For strictures above the peritoneal reflection, resection of the involved segment and end-to-end anastomosis is the operation of choice. Another procedure is to short-circuit the stricture by a lateral anastomosis between the loop of sigmoid above the constriction and the bowel below it. When neither of these measures is feasible, or in case complete acute obstruction has occurred, colostomy proximal to the stricture is indicated.

REFERENCES

- BENSAUDE, A., and MARCHAND, J. H. "Un traitement particulièrement efficace du rétrécissement inflammatoire du rectum," *Presse méd.*, Par., Dec., 1925, p. 1588.
- BLOOMBERG, M. W., and BARENBERG, L. H. *Am. J. Dis. Child.*, Chicago, 1925, 29: 206.
- BRAUN, W., and WORTMAN, W. *Der Darmverschluss*, Berlin, J. S. Springer, 1924, p. 319.
- CLEMONS, E. J. *Tr. Am. Proctol. Soc.*, 1923, p. 81.
- ERDMAN, Seward. *Ann. Surg.*, Phila., May, 1920, p. 637.
- GRAHAM, A. B. *Tr. Am. Proctol. Soc.*, 1909, p. 46.
- MUMMERY, P. Lockhart. *Diseases of the Rectum and Colon*, New York, Wm. Wood & Co., 1923.
- PICARD, Hugo. *Diathermiebehandlung der Stricturens Recti*, *Centralbl. f. Chir.*, Leipz., Aug., 1925, p. 1709.
- ROSSER, Curtice. "Rectal Pathology in the Negro," *J. Am. M. Ass.*, Chicago, 1925, 84: 93.
- WIENER, J. *Surg., Gynec. & Obst.*, Chicago, Feb., 1915, p. 223.
- WOODWARD, J. J. *Medical and Surgical History of the War of the Rebellion*, 1879, Vol. I, Part II.
- YEOMANS, F. C. "Strictures of the Rectum," *J. Am. M. Ass.*, Chicago, 1919, 73: 829-832.

CHAPTER XXI

PROLAPSE OF RECTUM AND SIGMOID

Prolapsus is an abnormal descent into the rectum or protrusion through the anus of one or more coats of the rectum or sigmoid.

Prolapse as an inclusive term indicates any form or degree of descent of the bowel. When the mucous membrane alone descends, the prolapse is *partial* or *incomplete*; when all tunics of the bowel are involved the prolapse is *complete*. Procidentia is used by some authors to indicate the degree of complete prolapse but the two terms have the same meaning.

PARTIAL PROLAPSE OF THE RECTUM

Partial prolapse of the rectum is a protrusion of the rectal mucosa through the anus. It is an exaggeration of the physiological eversion occurring at defecation and is the most common form of prolapse.

Etiology.—Partial prolapse is encountered most frequently in children under five years of age, many cases occurring in the first year. Fewer cases are observed in middle life but a considerable number in the aged. Anatomical factors predisposing to partial or complete prolapse in children are the unusual length of the intestine and its weak fixation, very slight sacral curve, and relatively high position of the bladder and uterus at birth. Development in later life usually corrects these mechanical disadvantages so that there is a natural tendency in time to overcome the prolapse.

The usual *exciting cause* of prolapse in children is any condition that produces a straining effort at stool and rectal tenesmus, as constipation, diarrhea, polypi, worms, phimosis, vesical calculus, whooping-cough and excessive vomiting. In the poorer classes it frequently accompanies bowel disturbances due to poor hygiene and improper diet. In serious illness and in marasmus, the fatty cushions normally supporting the rectum are more or less absorbed and extreme degrees of complete prolapse sometimes ensue. The pernicious habit of requiring constipated children to sit and strain on a high toilet until the bowels act, rather than squat, is one of the most frequent causes of prolapse.

In adults partial prolapse is frequently associated with protruding hemorrhoids and in the aged, with atrophic sphincters, it is a frequent occurrence.

Pathology.—The rectal mucosa is attached rather loosely to the underlying structures by fibrous and elastic tissue, which normally causes retraction of the mucosa after defecation. In pathological conditions, these tissues lose their elasticity and become permanently elongated and the mucosa is protruded to

an abnormal degree. The extreme limit of the mucosal protrusion is about 2 inches.

Symptoms.—The protrusion usually comes on gradually at stool and recedes spontaneously, but eventually may remain permanently extruded. Rarely the prolapse is acute, and unless relieved from the grip of the sphincters, may become strangulated or gangrenous and slough off.

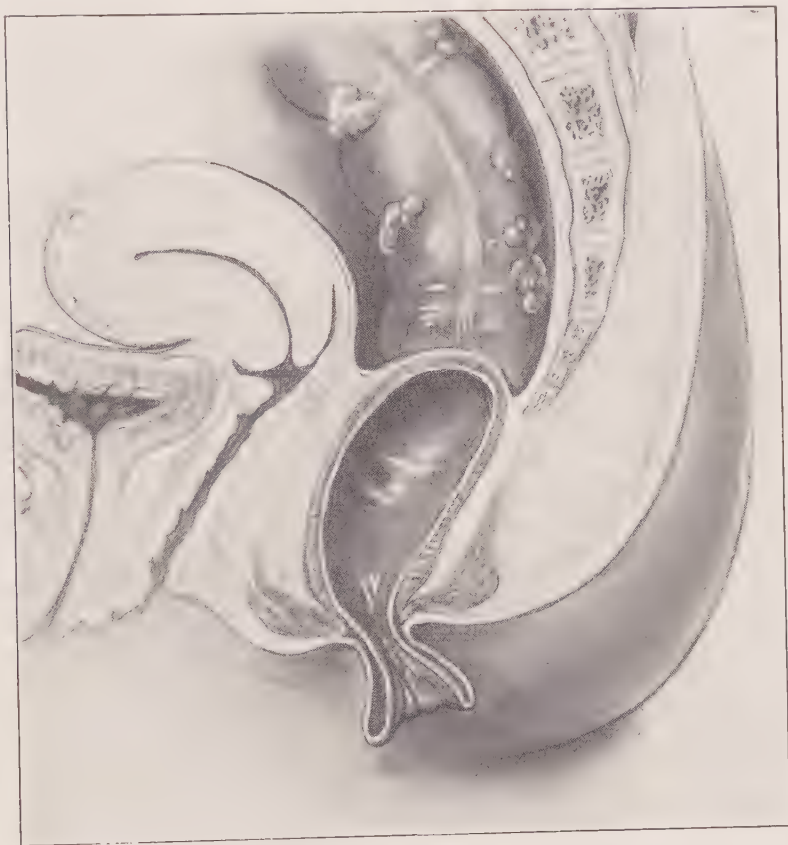


FIG. 240.—PARTIAL PROLAPSE OF RECTUM.
The protrusion consists essentially of a fold of mucosa.

The color at first is that of normal mucosa, but later it becomes bright red from irritation, and violaceous when constricted by tight sphincters. Secondary inflammatory changes occur in the mucosa, largely due to friction by the clothing, resulting in ulceration and a discharge of mucus, blood and pus which excites itching in the perianal skin. There is usually a complete ring of protrusion in children, but in adults a segment of mucosa only, may be involved. When the entire circumference descends the appearance is characteristic and diagnostic. The folds of mucosa radiate from the lumen as a center toward the circumference, while in complete prolapse they course circularly around the bowel.

Diagnosis.—The diagnosis is made by inspection. The chief differentiation is to be made from polyps in children, and piles in adults.

Treatment.—The majority of children are cured by correcting the cause of the prolapse. A suitable diet and proper regulation of the bowels are of prime importance.

Among palliative measures are small cold or astringent enemas, as alum 10 grains to the ounce, administered after every stool. The bowels should be moved with the patient resting on the side.

If protrusion occurs between stools the buttocks should be strapped with adhesive plaster. A single strip, $1\frac{1}{2}$ inches wide, is adjusted from one trochanter to the other so that its rear edge crosses just in front of the anus. With care the plaster is not unduly soiled and may remain for several days.

Tonics, as phosphorus, strychnia and cod-liver oil, are indicated for their general effect and in restoring tone in the relaxed muscular supports. Cod-liver oil is especially valuable in overcoming constipation and for its nutritive properties.

An acute prolapse in a child may be reduced readily by placing the patient prone and applying firm pressure for a short time to reduce congestion. Then slight manipulation will return the mucosa within the rectum.

When there is persistent recurrence of the protrusion in children and in cases of chronic protrusion in adults, surgical measures are indicated. In cases of mucous membrane prolapse due to the dragging down of internal hemorrhoids, removal of the hemorrhoids, preferably by the clamp and cautery method, assures a cure. In children and in adults, when hemorrhoids are not the cause, the two effective methods of dealing with the prolapse are linear cauterization and ablation.

Linear Cauterization.—This method of Van Buren aims to excite inflammatory adhesions between the mucous membrane and muscular coat of the bowel. The mucosa is held down with forceps, cleansed and dried. Then with the actual cautery heated to a dull red, lines of cauterization are made from the anal margin to the apex of the prolapse. Van Buren placed these lines about $\frac{1}{2}$ inch apart but their number, usually three or four, and distance vary with the size of the prolapse. Care must be exercised in the depth of burning; if too superficial, the reaction of the tissues is too mild, and if too deep complications may arise. For this reason, when cauterization is used in early complete prolapse, the burning on its anterior surface must be superficial lest perforation of Douglas' pouch take place, an unfortunate circumstance that has actually occurred. This may be avoided by burning deeply on the posterior surface of the prolapse, moderately at the sides and superficially on the anterior surface.

A vaselin gauze drain is inserted into the rectum, the patient kept recumbent for three weeks and evacuations obtained by enemas.

Ablation.—Operative removal of the mucosa is the simplest and safest procedure. This is accomplished by removing with the clamp and cautery longitu-

dinal strips of mucosa in practically the same manner as in the operation for hemorrhoids.

The other method of removal is by excision and suture of the mucosa. This is especially applicable in old people and local infiltration anesthesia is used as in hemorrhoidectomy. In case the entire circumference of mucosa prolapses, each lateral half is treated in turn. The prolapse is divided in its entire length at the posterior commissure. A strong linen suture is passed from the outer side of the prolapse through both layers of mucosa, taking in a liberal bite. This is tied very snugly in the groove previously made and the mucosa divided below the suture. Sutures are placed in a similar manner in succession until all prolapsing mucosa has been removed. The wound is painted with tincture of iodine and a generous compress of fluffed gauze is adjusted tightly. Minimal bleeding, early healing and slight scar with no tendency to stricture formation, all combine to make this curative procedure very satisfactory.

COMPLETE PROLAPSE OF THE RECTUM

In comparison to mucous membrane prolapse, complete prolapse is a rare condition. It is usually observed in adults, and only seldom in children. It occurs more frequently in men than in women and many chronic cases are noted in aged women who refuse radical treatment or in whom operative measures are contraindicated because of weakness and debility.

This form of prolapse involves all the coats of the rectum. When developed, it begins at the anal margin and its mucous membrane covering is continuous with the skin. This form is commonly known as *first degree* prolapse of the rectum. Occasionally the anal canal is not everted but the rectum protrudes through it. This is usually termed *second degree* prolapse and is readily recognized by a palpable sulcus of varying depth between the protrusion and anal canal.



FIG. 241.—COMPLETE PROCIDENTIA RECTI—FIRST DEGREE.

This form of prolapse never succeeds partial prolapse nor does it result from hemorrhoids or neoplasms situated within the distal 3 centimeters of the rectum. It may be due to a stricture, neoplasm or ulceration of the bowel at any point above this level. The protrusion varies from 2 or 3 to 6 inches in length. Complete procidentia is usually a continuation of a partial prolapse but it may be complete from the beginning.

Etiology.—The same factors as produce partial prolapse may cause the complete form. In addition, injury of the fascial and muscular supports of the lower rectum are important etiologically, as neglected laceration, or rupture of the perineum in women; poor repair of the pelvic diaphragm after hysterectomy and injury of the sphincter by too forcible dilatation, its division at operation for fistula, or excision of a section of the muscle, as occurred in a patient

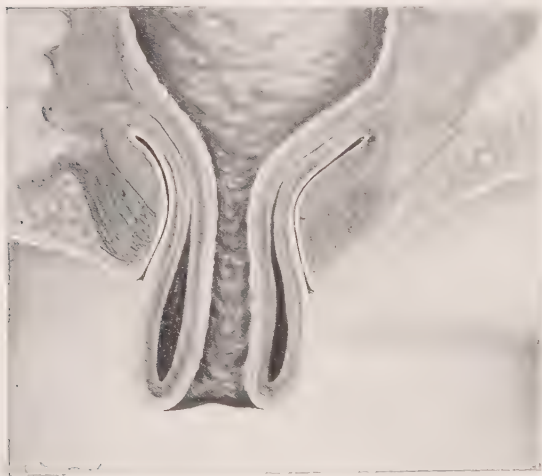


FIG. 242.—COMPLETE PROCIDENTIA RECTI—SECOND DEGREE.

referred to the author for prolapse and incontinence after a careless hemorrhoidectomy.

Local causes within the bowel are mucous membrane growths, as a solitary polyp of the rectum or lower sigmoid, acting as a foreign body; organic stricture of the bowel, and rectal constipation (dyschesia). Chronic wasting diseases and lesions of the spinal cord, more often observed in men, as tabes dorsalis, predispose to prolapse.

Exciting causes are the increased intra-abdominal pressure and repeated strain, associated with hypertrophied prostate, urethral stricture, vesical stone, a chronic cough or heavy lifting. Hence, recurrent and persistent prolapse occurs most frequently in adults and in advanced age when the supports of the rectum, especially the muscles, have lost their tonicity and the factors of strain have become operative.

Pathology.—Many theories of the causation of complete prolapsus recti have been advanced, any one of which may explain in some degree an individual case, but none of which is satisfactory for all cases. The true situation probably is that a number of factors enter into the etiology, and that their combined effect results in a prolapse.

In 1902 Bardenhauer and later Quénu and Duval treated rectal prolapse on the theory that it was a hernia of the peritoneal pouch of Douglas. Later Moschcowitz elaborated this theory. He regards prolapse as a true hernia of the sliding type. All the large vessels and all the viscera of the abdomen *lie upon* the transversalis fascia and are *covered* by the peritoneum. Herniæ occur only where blood-vessels or viscera make their exit normally. These weak points are the attenuated perivascular or perivisceral projections of the transversalis fascia. In the case of rectal prolapse, the pouch of Douglas is the sac of the hernia, and the point of exit is a defect in the attenuated outward prolongation of the transversalis fascia upon the rectum. According to Moschcowitz



FIG. 243.—COMPLETE PROLAPSE OF RECTUM.
Boy, aged four years.



FIG. 244.—COMPLETE PROLAPSE OF RECTUM, SIX YEARS' DURATION.
Female, aged forty-eight.

the prolapse begins as a hernia of the small intestine passing through a fascial defect at its point of attachment to the anterior rectal wall. The pouch of Douglas is invaginated through the anterior rectal wall above the anal canal. The reason why the hernia has no distinct and separable peritoneal sac is that the peritoneum covering the anterior wall of the rectum is firmly adherent to it. Consequently the hernia is of the sliding type. The exciting factor is increased intra-abdominal pressure and persistence of this, forces the hernia backwards

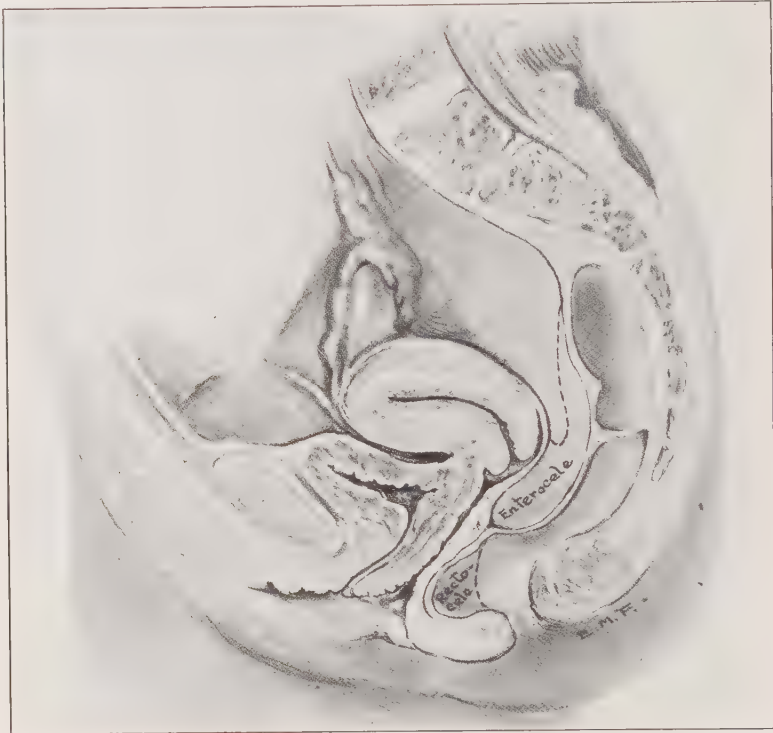


FIG. 245.—ENTEROCELE AND RECTOCELE.

Dotted lines indicate normal limits of culdesac of Douglas and rectum. (Courtesy of G. G. Ward in Kelly, *Gynecology*, D. Appleton & Co., New York.)

toward the sacrum and coccyx, then downward and forward, and finally, overcoming the resistance of the anus, the prolapse appears externally.

Enterocoele.—Zuckerkindl and others have demonstrated that normally in the fetus the peritoneal pouch extends to the levatores, whence it rises gradually to the level of the second or third sacral vertebra at puberty. Rarely, however, the congenital deep culdesac persists, approaching near the perineum. Thus, enterocele, also called posterior vaginal hernia in women, may be due to a congenital deep peritoneal pouch, or be acquired by herniation of the peritoneum through a congenital defect of the fascia or its separation from the anterior rectal wall during gestation and labor.

Rectocele.—Rectocele or posterior vaginal hernia is a prolapse of the anterior rectal wall, most commonly through the vagina, due to injury of the pelvic floor at parturition. The vaginal wall bulges downward and forward, carrying the attached rectum with it. With the removal of the anterior support of the rectum, intra-abdominal pressure and pressure of the fecal contents are exerted mainly at this point, eventually producing a distinct rectal pouch. The differentiation of rectocele from enterocele is a simple matter. With a finger of



FIG. 246.—ENTEROCELE.

Frozen section from Halban and Tandler demonstrating relation of a deep culdesac of Douglas to prolapsus. Pouch filled with intestines exerts traction on cervix.

one hand in the rectum, the posterior vaginal wall is drawn forward with the other hand. In rectocele, the rectal wall is carried forward, whereas in cystocele it remains back, due to the interposition of the peritoneal pouch between the two organs.

In women the peritoneal culdesac is nearer the perineum than in men. If the prolapse protrudes more than 2 inches in women or 3 inches in men, it may include on its anterior surface a portion of the peritoneal cavity.

In larger prolapsus more of the peritoneal cavity is dragged down and the invaginated bowel is usually completely surrounded by peritoneum except at its mesenteric attachment. Under such circumstances the peritoneal pouch may be empty but usually contains loops of small intestine, thus constituting a rectal hernia or archocele.

Presence of the intestine in the hernial sac may be recognized at times by a tympany on percussion and by the gurgling and recession of the bowel upon

manipulation as in inguinal hernia. Rarely adhesions form between the herniated intestine and its sac, so that when the hernia is reduced the prolapse goes with it.

A prolapse of the rectum may reach enormous proportions but its usual limit is from 3 to 6 inches. Ordinarily the prolapse is straight and its orifice at or near the apex. When the protrusion is 5 or 6 inches in length it curves backward toward the sacrum due to traction by the mesorectum.

Symptoms.—In prolapsus recti, the protrusion usually develops gradually. At first it is slight, occurs only at stool and is reduced spontaneously by the action of the levator muscles. In the course of time the procidentia becomes larger and must be replaced by hand. Eventually the anal sphincters become so

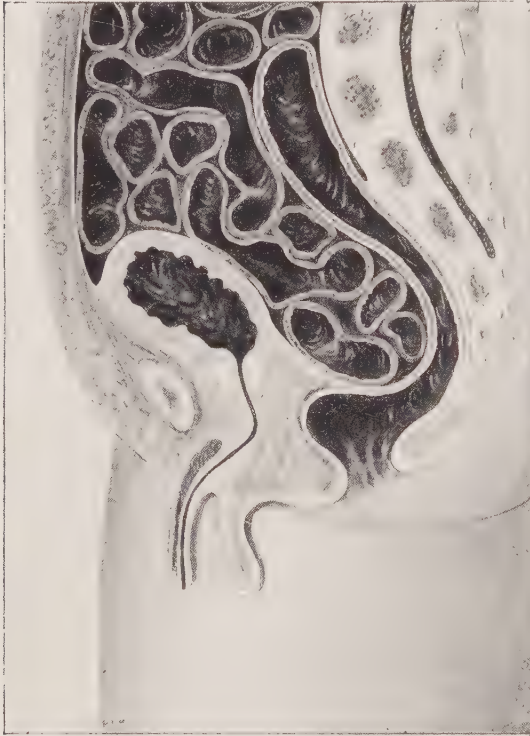


FIG. 247.—RECTAL HERNIA OR ARCHOCELE.

relaxed that the reduced prolapse may recur at once or as soon as the patient moves about. In certain cases, the bowel finally remains permanently extruded, due to adhesions and inflammatory swelling, and cannot be replaced. In these constantly recurring and irreducible cases, congestion and hypertrophy of the mucosa ensue, and later induration and ulceration, with discharge of mucus, pus and blood. Frequently the state of the patient is indeed pitiable and elderly people, in whom this extreme condition most often occurs, can neither sit nor walk but become confirmed invalids, confined to bed with rectal and vesical incontinence.

Ordinarily, when the bowel remains reduced between the acts of defecation, constipation is the rule in both children and adults until the rectal mucosa

becomes inflamed and ulcerated. Then a tantalizing diarrhea may begin with a discharge of blood-tinged mucus and some feces which the relaxed, insensitive anal aperture cannot retain. Pain is not a prominent symptom.

As a rule the condition is not dangerous but incapacitates the patient. However, in certain instances, usually due to accident, injury, or excessive physical effort, the rectal prolapse is acute. In these the intact functioning sphincters grasp the suddenly extruded bowel tightly, the return circulation is impeded and gangrene may result unless prompt reduction is obtained.

A complete prolapse is recognized at once by the direction of the rugæ of its mucosal covering. They run circularly about the protrusion in contradistinction to the incomplete form where they radiate from the apex to the circumference. In old-standing cases the rugæ may be obliterated and the mucosa smooth and shining.

Complications of Complete Prolapse.—Complications of the same character as are observed in hernia in other situations may occur in this form of prolapse. Adhesions between the sac and its contained viscera may prevent reduction of its contents, or inflammatory constriction of its neck may result in strangulation.

A rarer complication is spontaneous rupture of the rectal wall and protrusion of intestine through the rent. In the cases reported by Quénu, protrusion of the small intestine from the anus was followed by a reduction of the rectal prolapse. The usual exciting cause of spontaneous rupture is a violent strain as vomiting, defecation or lifting a heavy weight. The possibility of this accident should be borne in mind when attempting forcible reduction of a prolapse and it should not occur if the patient is under general anesthesia.

Sigmoidorectal Prolapse.—This consists in an invagination of the lower portion of the sigmoid and upper rectum into the rectal ampulla. It is in reality an intussusception which differs from the ordinary type in that it is intermittent, usually does not cause strangury or complete obstruction, and the opposed peritoneal coats do not adhere to each other, preventing spontaneous reduction. The intussuscepted bowel descends into the rectal ampulla but ordinarily it does not protrude through the anus. The anal canal is not involved in the prolapse.

Etiology.—Frequently neoplasms, especially a large solitary polyp, and less often stricture situated high, produce sigmoidorectal invagination. This type of case with evident or demonstrated gross pathological cause is not included in the class of cases now under consideration.

Sigmoidorectal prolapse is a condition much more prevalent than is generally recognized. The two classes of patients in which it is most frequently found are constipated children and enteroptotic adults. It is not unusual in old people.

Habitual constipation is the rule in the beginning at least. The constipation is of the rectosigmoidal type (dyschesia) which is aggravated by cathartics and relieved by enemas which elevate the bowel to normal position.

Hirschman, of Detroit, reported three cases of prolapse of the rectum and

sigmoid following hysterectomy which illustrates the close association between the supports of the uterus and distal colon.

Symptoms.—The characteristic symptom is a feeling of unsatisfactory and incomplete evacuation at defecation. The sensation is that something remains that should be expelled, consequently the patient sits and strains inordinately. This aggravates the tendency to prolapse and together with its frequent descent and recession frequently results in a congestion and superficial ulceration of the mucosa at the apex of the prolapse. A heavy dragging sensation in the lum-

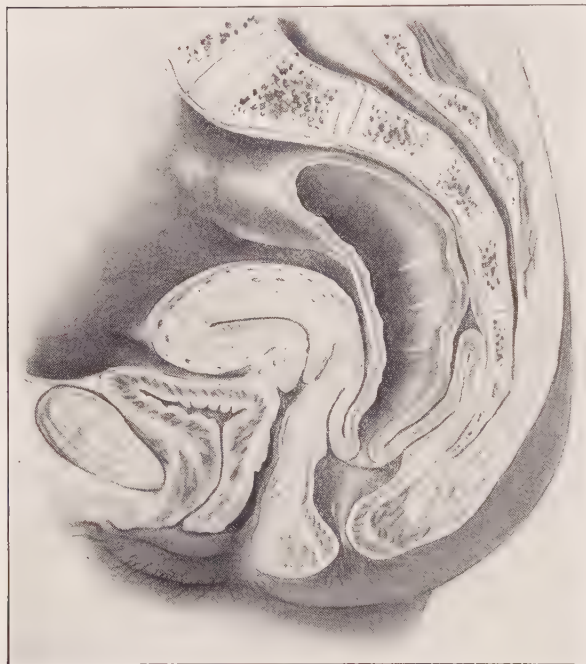


FIG. 248.—PROLAPSE OR INVAGINATION OF SIGMOID INTO THE RECTUM, SO-CALLED THIRD DEGREE PROLAPSE OF RECTUM.

bar and sacral regions, due to the mesenteric tug, are usually present, and dull aching pains referred to the thighs or perineum. Associated symptoms are intestinal indigestion, flatulence and colitis. The mucus discharge at first is clear but later may be blood tinged.

Although the condition is essentially chronic, attacks of acute invagination occur occasionally. Monsarrat considers it "a condition to be borne in mind when a patient comes complaining of pelvic and perineal pain, spasmodic in character and of a peculiar paralysing and distressing type, associated with the passage of mucus and perhaps blood."

Villous tumor and other rectal conditions give much the same symptoms but sigmoidorectal prolapse must be considered in making the diagnosis. Monsarrat reports three cases, one of which, with symptoms of low bowel obstruction, required immediate laparotomy. The invagination was reduced without difficulty and sigmoidopexy done. Relief was permanent.

Eleven years ago, the author had a similar case with symptoms of complete obstruction in a physician who was prepared for laparotomy, but insufflation of air through a proctoscope promptly effected reduction and there has been no recurrence of the condition.

During the acute attacks abdominal colic, nausea and fainting may occur, and severe anal spasm interfere with examination.

Diagnosis.—The anatomical conditions predisposing to this form of prolapse are an abnormally long sigmoid having a long lax mesentery and a wide recto-sigmoidal angle. These congenital conditions are found in many children and may persist in adult life. An x-ray examination will usually demonstrate a redundant sigmoid, prolapsing into the pelvis. To digital palpation the rectum is of large lumen and its walls relaxed. In the rare event of incarceration or acute prolapse there may be felt a protrusion into the ampulla with an orifice at its apex.

Chief reliance for the diagnosis, however, rests upon sigmoidoscopic examination, which at the same time rules out other lesions giving rise to similar symptoms. With the patient in the knee-chest position the tube is passed into the sigmoid and as it is gradually withdrawn the patient is asked to strain down at intervals. The bowel then prolapses into the tube with each straining effort and recedes spontaneously when the patient relaxes.

Reduction of Prolapse.—When a prolapse does not recede of itself or cannot be reduced by the patient, taxis must be used. If the parts are edematous, hot fomentations should be applied to reduce the swelling before attempting reduction. The patient is placed preferably in the chest position, or failing this, in the left lateral position with the hips elevated, which favors decongestion and gravitation of the intestine upward.

Taxis is always made from the apex of the protrusion through the lumen of the bowel. The index finger wrapped with a cone of dry tissue paper is gently pushed upward into the lumen. This carries with it the inner layer of the prolapse and turns in the outer layer. The finger is withdrawn, leaving the paper in place, and the maneuver repeated until reduction is accomplished. In cases of acute prolapse, the tight, spasmodic sphincter may constrict the gut and prevent reduction. Under these circumstances, prolonged manipulations are injurious; local or general anesthesia should be administered, the sphincter stretched and the protrusion reduced. A compress is adjusted firmly to the anus to prevent a recurrence of the prolapse during the period of nausea and straining incident to the general anesthesia. The patient is confined to bed for a few days and the bowels moved in a recumbent posture. With due care subsequently, the prolapse may not recur. In the unusual event that the bowel has become gangrenous, reduction should not be attempted, lest perforation and a fatal peritonitis ensue. Immediate amputation of the entire prolapse is indicated and if the peritoneal cavity is opened during the operation, it must be drained.

Treatment of Complete Prolapse

General tonic measures, diet and care of the bowels, as detailed under incomplete prolapse, are much more likely to be successful in children than in adults. The palliative treatment of rectosigmoidal prolapse is given in the chapter on Constipation.

Rectal plugs and compresses applied over the anus for purposes of support

are not satisfactory. Their constant pressure causes local irritation and ultimately relaxation of the sphincter muscle, thus defeating their purpose.

The injection of irritating drugs and chemicals into the perirectal tissues with the object of producing inflammatory adhesions between the bowel and perirectal tissues is a relic of the past and seldom practiced at present. Solutions of ergotin, strychnin or phenol were most commonly used.

The injection of paraffin wax in the submucosa and around the rectum to cure prolapse has been done many times. Satisfactory results were reported in some cases treated by this method, in that descensus did not occur. However, the wax is an irritating foreign body in a region prone to infection. Two years after the injection, Wallis observed ischiorectal abscess and a fistula which were difficult to cure. Mummery saw a very severe rectal stricture develop as a sequel. The method has nothing to commend it, in theory or practice, and it should be abandoned.

Operative Treatment of Complete Prolapse.—Very few other conditions have so taxed the ingenuity and skill of the surgeon, as has complete prolapse, in devising methods of operative cure. Medical literature fairly teems with different procedures each of which is credited with cures in specified cases. The fair presumption is that the period of observation after operation was too short to correctly gauge late results and that ultimately there were recurrences in many instances. The fact that new and different methods are being proposed is convincing proof of the inadequacy of the older procedures. A better understanding of the pathology of prolapse is the basis upon which the newer operations are built, with the idea of firm anatomical restoration of the parts.

Surgery aims to restore and maintain the parts in their normal position. Naturally the procedure must be adapted to the form of the prolapse, the point where it begins and the extent or degree of descensus.

The types of operation for major prolapse are:

1. Rectopexy: Some form of fixation of the rectum to the sacrum and coccyx, also suspension or anchorage of the anterior rectal wall.
2. Sigmoidopexy: Suture of the sigmoid to the abdominal wall or to the iliac fascia.
3. Obliteration of the peritoneal pouch of Douglas.
4. Amputation of the rectum.

Supplementary to these procedures are:

5. Rectorrhaphy, designed to narrow or shorten the rectum by operations on its mucosa or other coats.
6. Plastic narrowing of the anal aperture.

An operation that relieves the symptoms may be satisfactory to the patient although an anatomical cure has not been obtained. A single procedure may be sufficient in certain cases while in others a combination of methods is necessary. Thus an operation on the lower rectum may prevent external protrusion,

and conceal an invagination at a higher level which could only be corrected by an operation through the abdomen.

Plastic Narrowing of the Anal Outlet.—For recent prolapse and those of mild degree the operation may be limited to the mucosa. Four generous strips of mucosa are removed in a longitudinal direction at equal distances on the circumference of the bowel. Each strip extends from the anal margin to the apex of the prostate. The simplest and safest way to accomplish this is to elevate the mucosa with several pairs of forceps, apply a narrow-bladed crushing clamp at its base, burn away the mucosa superficial to the clamp, and apply a



FIG. 249.—RECTOPEXY FOR PROCIDENTIA RECTI: THE INCISION.

running suture of chromicized catgut over the clamp as in the Earle operation for hemorrhoids, slip out the clamp, tighten the suture and tie its ends together. A tube is inserted into the rectum and strips of vaselin gauze on all sides of it. The buttocks are strapped together by adhesive plaster. The patient is confined to bed for six days and then the bowels are moved by an enema.

If the sphincters are atonic and the anal canal relaxed the aperture is narrowed by one of the methods described in the chapter on Incontinence. Delorme removes the entire cuff of mucosa covering the outer cylinder of the rectal prolapse. Later Bier supplemented this by reefing the submucous structures thus forming a reduplication which he claims narrows the anal canal and strengthens the external sphincter. Finally the cut edge of the mucosa is sutured to the skin. Naturally these methods are of very limited application.

Rectopexy.—In 1892, Verneuil exposed the rectum through a median incision from the posterior margin of the anus upward alongside the coccyx. The

levator muscle is separated from the gut and by sutures through the muscular layer, its walls are reefed in transverse folds, thus shortening it. He then attached the rectum to the sides of the sacrum and coccyx by buried sutures.

Fowler, in 1897, was the first to anchor the rectum to the coccyx by sutures carried around the bone.

Tuttle enhanced the value of the operation by attaching the rectum to the sacrum as follows:

SACRAL RECTOPEXY.—The patient, under general or spinal anesthesia, is placed in the left semiprone position with the hips elevated on pillows and the



FIG. 250.—RECTOPEXY: THE GUT INVERTED AND BROUGHT THROUGH THE INCISION; THE SUTURES PASSED THROUGH ITS MUSCULAR WALLS.

thighs well flexed on the abdomen. The prolapse is then dragged down to its full extent and held forward by an assistant. A curved incision about 2 inches in length is made midway between the coccyx and anus, and carried through all the tissues into the retrorectal space. The fingers introduced through this incision separate the rectum from the coccyx and sacrum posteriorly, as high up as the attachment of the mesorectum, and on the sides as far as the attachment of the lateral ligaments which are carefully preserved.

The anterior surface of the bone is then gently curetted to remove all the fatty tissue and freshen it. At this point the assistant reduces the prolapse, and with his fingers within the lumen pushes the gut out through the incision.

The operator drags the gut down as far as it will come, usually a little less than the amount prolapsed through the anus. Heavy silkworm gut sutures are then passed transversely through the muscular layer, embracing as much of the

circumference of the gut as possible. About four sutures are thus inserted $\frac{1}{2}$ inch apart, and their ends left 6 to 8 inches long. After the sutures have been placed, the ends of the upper one are each in turn threaded on a long, curved Peasley needle and carried up through the wound to the highest point of the separation between the rectum and sacrum, where they are passed through the tissues, and are brought out through the skin, on opposite sides of the bone. The other sutures are passed in like manner, each being brought out $\frac{1}{2}$ inch lower than the preceding one. The ends are then drawn taut, thus dragging the rectum up into the hollow of the sacrum where it naturally belongs. The



FIG. 251.—RECTOPEXY: THE SUTURES OUT THROUGH THE TISSUES ON EACH SIDE OF THE SACRUM.

sutures are tied over a pad of gauze placed over the sacrum to avoid their cutting into the skin. Before tying the sutures all clots should be removed from the retrorectal space and oozing checked. The gut is thus anchored closely to the sacrum where it adheres in due time. The external wound is closed by buried catgut and subcutaneous sutures. If the sphincters are much relaxed, plastic repair may be done or a ligature of kangaroo tendon may be passed around the anus at the upper margin of the external sphincter, and tied over the index finger introduced through the anus (Fowler, Platt). This narrows the anal outlet and causes contracture of the sphincter, thus contributing to the cure.

The bowels are moved on the eighth postoperative day by enemas, but the patient is confined to bed two weeks longer and does not sit on the toilet until the end of that time. The anchoring sutures are removed on the tenth to the fourteenth day.

The method is applicable only in those cases in which the prolapse is limited to the rectum and below that portion which is largely surrounded by peritoneum. It suspends the rectum by its posterior and lateral walls but does not directly support its anterior wall.

This operation has been employed with satisfaction in a comparatively large number of cases, the protrusion in some of them being as much as 5 or 6 inches. In seven of Tuttle's cases there was no recurrence in from one to three years after operation.

Tamponade of Retrorectal Space.—Sick and Mummery recommend tamponade of the retrorectal space to anchor the rectum to the sacrum and sur-

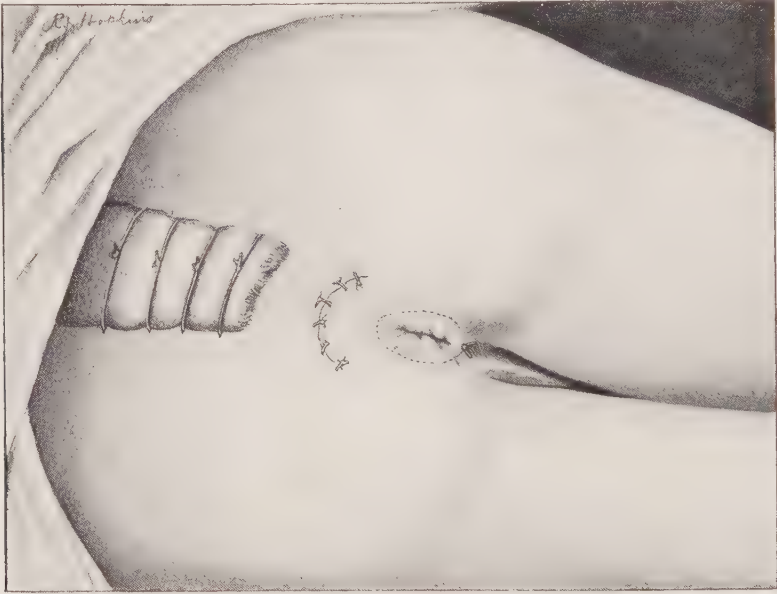


FIG. 252.—RECTOPEXY: THE OPERATION COMPLETED.

rounding pelvic fascia. The space is opened up as in Tuttle's operation for sacral rectopexy. Then a long strip of sterile vaselin gauze with selva edge is carefully but loosely packed to the limits separated in the postrectal space. The object is to prevent primary union between the rectum and the sacrum by the interposition of gauze. The use of two or three strips of gauze may be required, their ends left protruding from the wound. If the anus is patulous, a plastic repair is done later, but before the patient is allowed to be up. A tube is placed in the rectum and gauze adjusted externally. At the end of a week the tampon is removed, under an anesthetic, and another introduced. From five to seven days later all packing is removed and a drainage tube inserted. The object is to obtain slow healing by granulations, and a firm fibrous union of the posterior surface and sides of the rectum to the sacrum and fascia. For this reason the wound is prevented from healing for three weeks or longer.

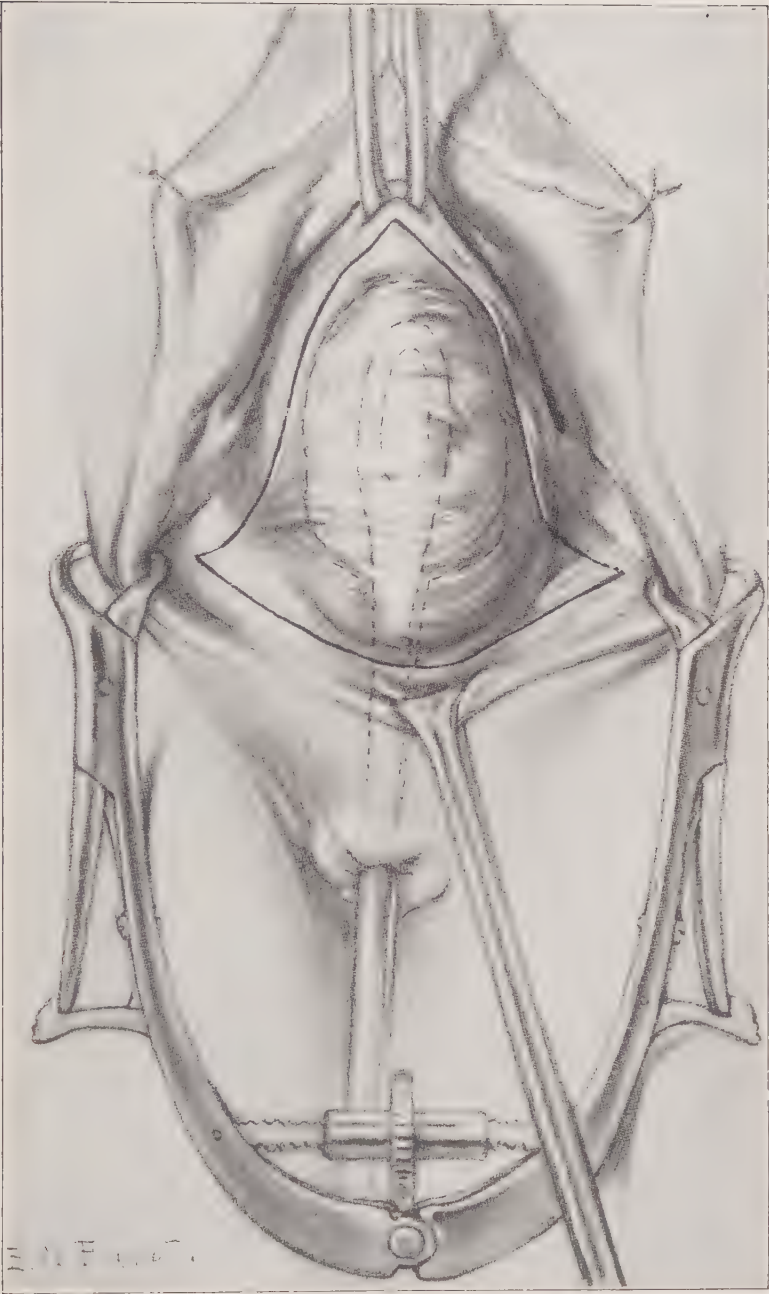


FIG. 253.—SPONGE IN RECTUM OUTLINES RECTOCELE.

Friedman retractor opens introitus widely exposing vaginal sulci. Triangular area of vaginal wall which is to be removed is outlined with a scalpel. (Courtesy of G. G. Ward in Kelly, *Gynecology*, D. Appleton & Co., New York.)

The bowels are first moved by an enema on the seventh postoperative day before removal of the packing. Enemas are used daily thereafter. The patient is confined to bed for one month, and moves the bowels one month longer on a bed-pan. Mummery performed this operation thirty-two times. Failure of per-

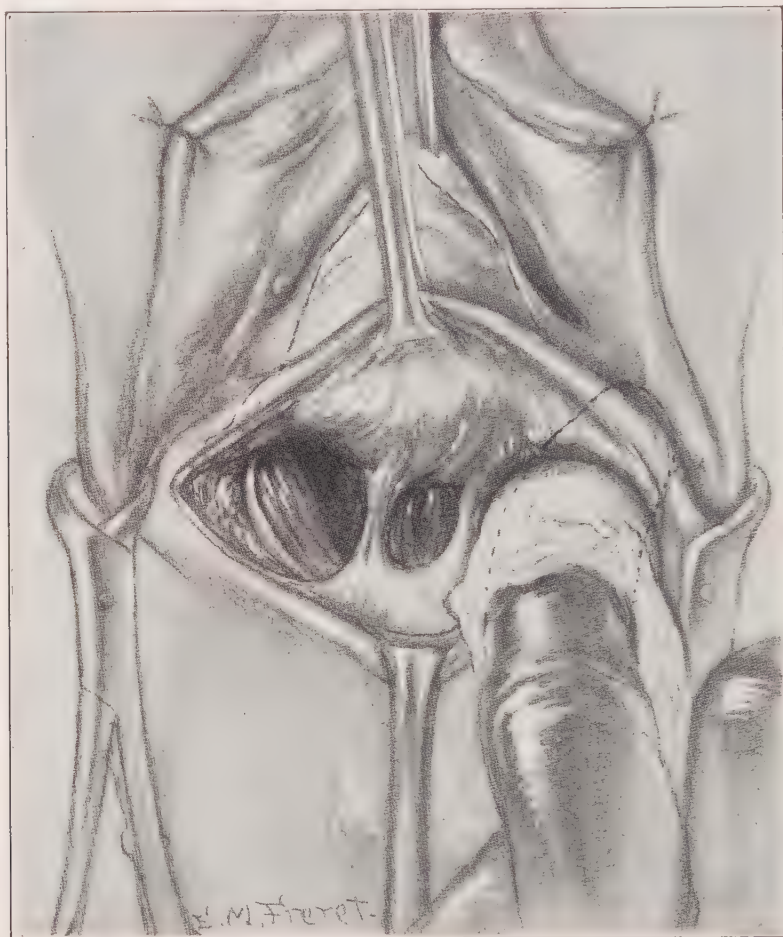


FIG. 254.—SUPERFICIAL AND FUSED FASCIAL STRUCTURES CUT THROUGH AND LEVATOR MUSCLE AND RECTUM SEPARATED IN EACH SULCUS BY BLUNT DISSECTION WITH GAUZE-COVERED FINGER. ANTERIOR FIBERS OF LEVATOR FREELY EXPOSED.

(Courtesy of G. G. Ward in Kelly, *Gynecology*, D. Appleton & Co., New York.)

manent cure occurred in only three cases, two of which were cured later by repeating the operation.

As rectosacropexy exerts its main influence on the posterior and lateral walls of the rectum, in women, especially with a laceration of the perineum, a supplementary perineorrhaphy is essential to support the anterior rectal wall

by uniting the levator muscles as high up as possible in front of it. This suffices for small or moderate-sized rectocele. For larger rectoceles, an anterior rectopexy is indicated.

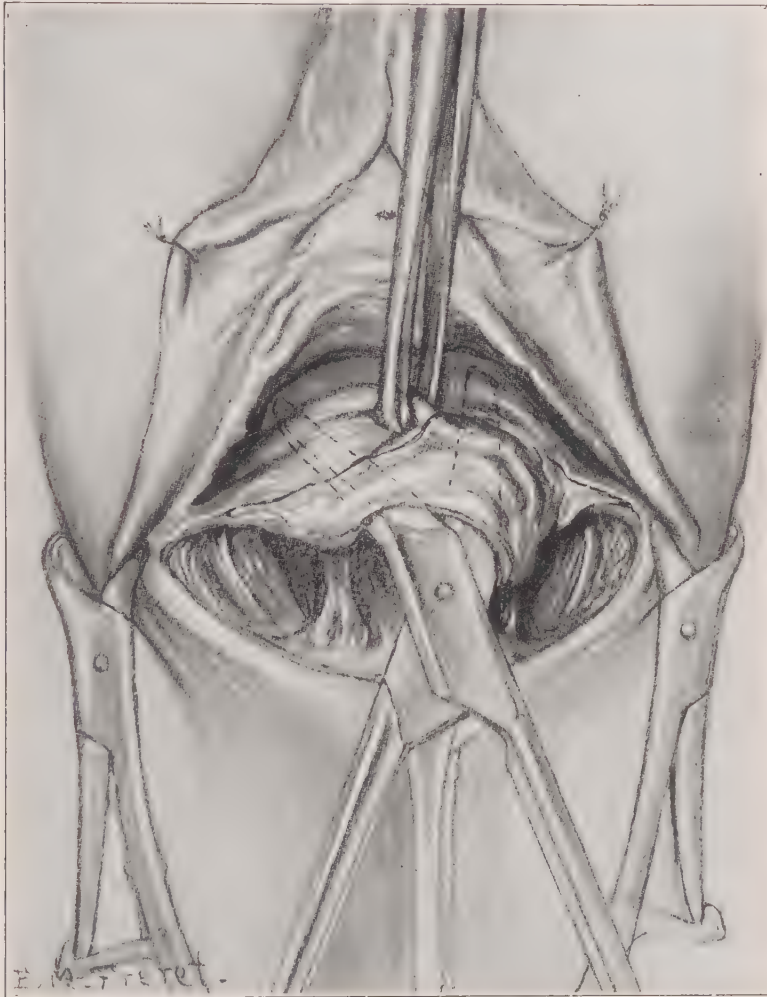


FIG. 255.—RECTUM SEPARATED FROM VAGINAL WALL WELL ABOVE AREA OUTLINED FOR REMOVAL.

Blunt-pointed angular scissors inserted in line of cleavage while closed, then opened widely and withdrawn while open. Sponge forceps in rectum is a guide to the path of safety. (Courtesy of G. G. Ward in Kelly, *Gynecology*, D. Appleton & Co., New York.)

Anterior Rectopexy and Rectorrhaphy.—According to Spalding, rectocele occurs in women in more than 20 per cent of the cases in which the usual type of perineorrhaphy is done. For this reason, Spalding, Ward, and others, combine with the perineorrhaphy a transverse plication of the anterior rectal

wall, which is elevated and anchored by suture to the pelvic fascia around the sacro-uterine ligaments (Spalding), or to the upper portion of the posterior

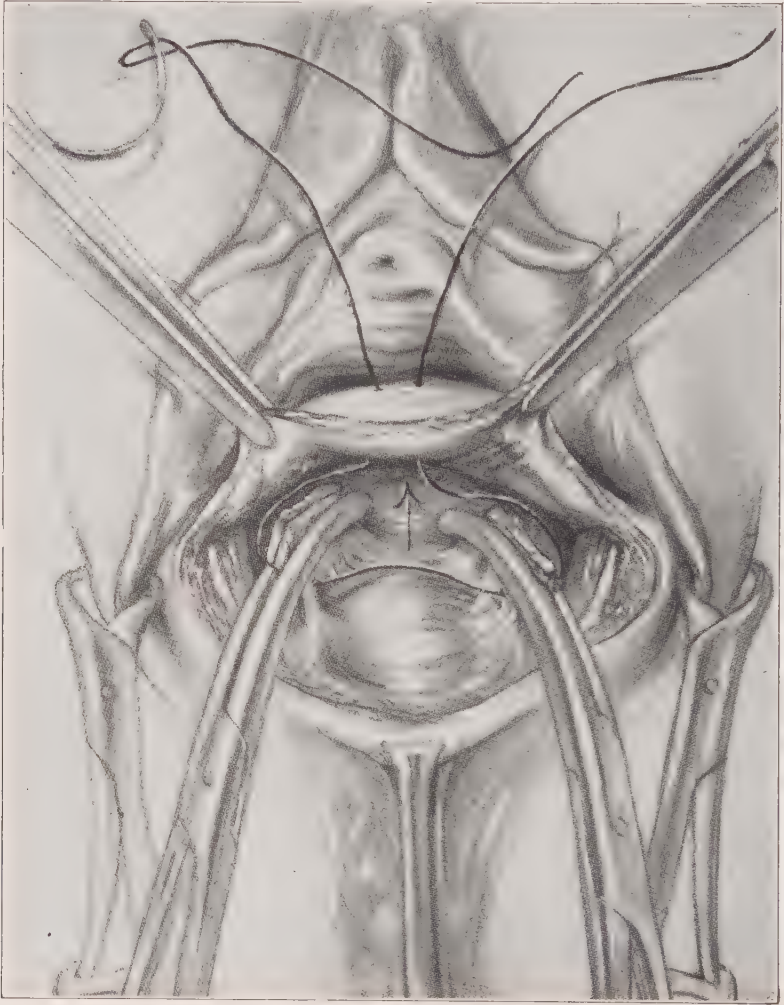


FIG. 256.—RECTOPEXY.

A suture is passed through vaginal wall in midline well above position of rectocele and is brought down between vagina and rectum and passed through lower margins of fascial stumps and returned through vaginal wall close to point of origin. Clamps removed and suture tightened and tied. Mobile rectal pouch thus drawn upward and fastened to undamaged vaginal wall above site of rectocele. (Courtesy of G. G. Ward in Kelly, *Gynecology*, D. Appleton & Co., New York.)

vaginal wall (Ward). G. G. Ward has kindly granted the writer permission to use Figures 253-261 which clearly illustrate his method of dealing with rectocele and cystocele. Results have been uniformly successful for many years.

RECTOCELE.—With a gauze sponge on a sponge holder inserted into the rectum as a guide, a triangular area is outlined with a scalpel on the posterior vaginal mucosa, its apex being at the crest of the rectocele. Next, the posterior vaginal wall is separated freely in its line of cleavage between the rectum and

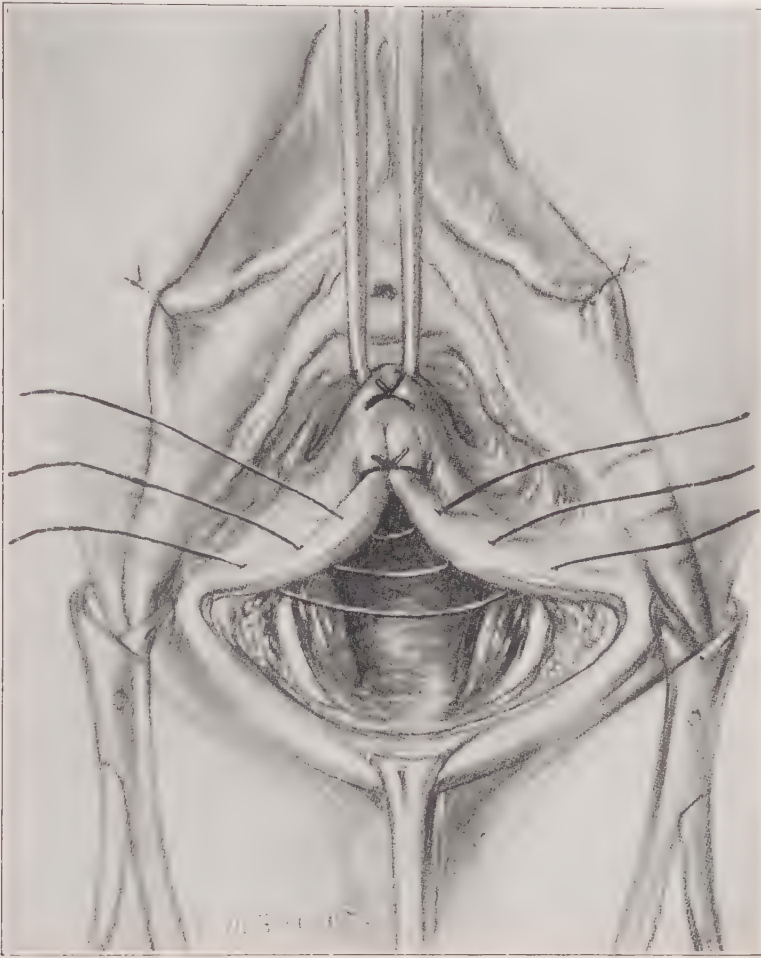


FIG. 257.—CUT EDGES OF VAGINA SUTURED, CARE BEING TAKEN TO INCLUDE THE TWO FASCIAL STUMPS IN THE UPPER SUTURES TO INSURE CLOSURE OF SPACE BETWEEN THEM.

(Courtesy of G. G. Ward in Kelly, *Gynecology*, D. Appleton & Co., New York.)

levator muscle in each sulcus. The vagina is then dissected bluntly from the rectum well above the crest of the rectocele. The rectovesical fascia thus exposed on each side is clamped and cut on the vaginal side of the clamp. A heavy chromic gut suture is then passed transversely through each fascial stump on the exposed rectum, and through the vaginal flap near the midline at the upper limit of its separation. When this suture is drawn taut and tied, it

plicates the gut transversely and fixes it in an elevated position where firm adhesions unite it to the sound upper third of the posterior vaginal wall, well above its former site of protrusion. The triangular vaginal flap, delimited as the first step in the operation, is resected and its margins united with interrupted

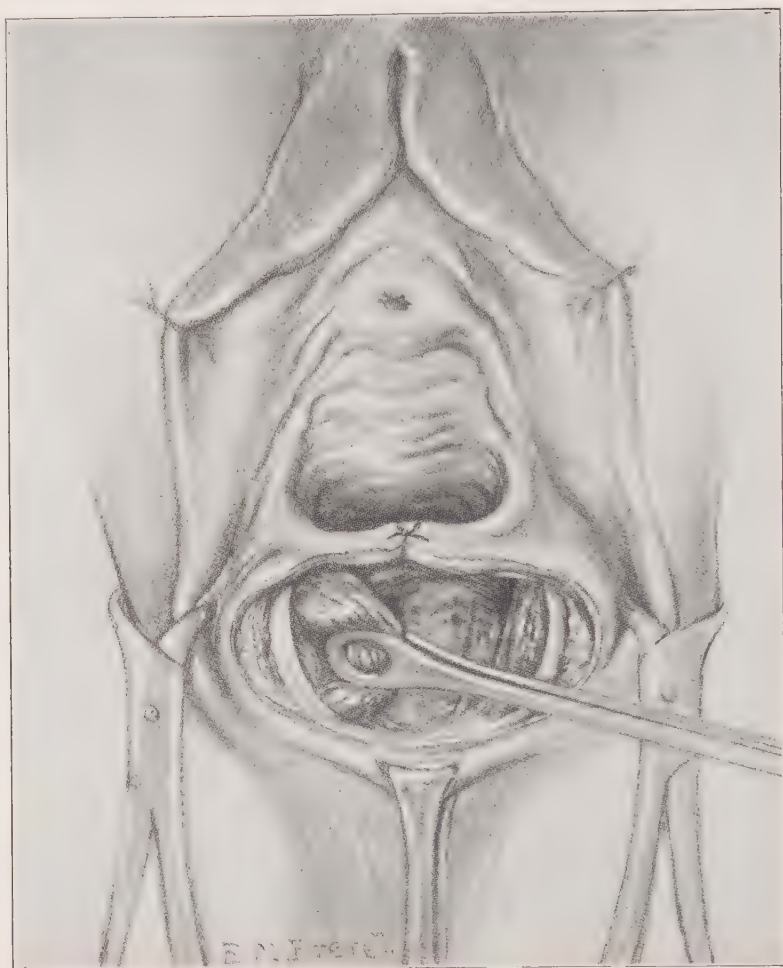


FIG. 258.—ANTERIOR MARGINS OF LEVATORES GRASPED WITH SPONGE FORCEPS AND DRAWN TOWARD MIDLINE.

(Courtesy of G. G. Ward in Kelly, *Gynecology*, D. Appleton & Co., New York.)

chromic gut sutures, including in the upper sutures the fascial stumps. The exposed levator muscles are sutured together in front of the rectum as high as possible. The operation is completed by a continuous suture passed deeply to include Colles' fascia and the fused fascial structures of the urogenital diaphragm; and a subcuticular suture to close the skin. To prevent deep oozing, the vagina is packed with sterile gauze.

The results of this operation in relief of symptoms in rectocele alone have been uniformly good in hundreds of cases, but when complicated by

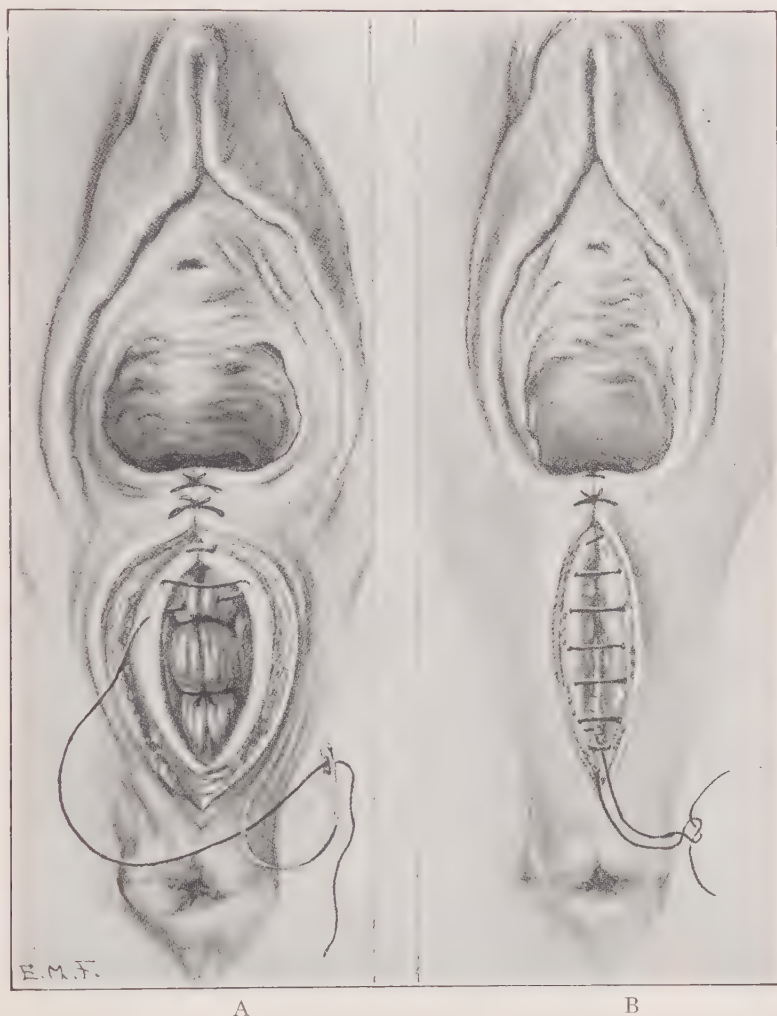


FIG. 259.—A. LEVATORES SUTURED TOGETHER WITH INTERRUPTED CATGUT SUTURES. SHARP EDGE OF COLLES' FASCIA SEEN ON EACH SIDE OF WOUND NEXT SUTURED WITH CONTINUOUS SUTURE, WHICH AT ITS ORIGIN IS PASSED WIDE AND DEEP TO INCLUDE FUSED FASCIAL STRUCTURES AT THIS POINT. SUTURE ALSO CATCHES UNITED LEVATORES. B. SKIN MARGIN THEN CLOSED WITH A SUBCUTICULAR TANNED CATGUT SUTURE AND END TIED TO FASCIAL STITCH. THE KNOT DISAPPEARS BETWEEN MARGINS OF THE INCISION.

(Courtesy of G. G. Ward in Kelly, *Gynecology*, D. Appleton & Co., New York.)

cystocele, Spalding's series of 131 cases showed a recurrence of the rectocele in thirty-one, or 24 per cent, while in fifty-five cases which also had a complete prolapse of the uterus, rectocele recurred in twenty-two, or 40 per cent.

This is a marked improvement over the results obtained by ordinary perineorrhaphy for these conditions. The period of observation on these patients varied from three months to six and one-half years after operation.

ENTEROCELE.—Posterior vaginal hernia is of relatively frequent occurrence. Due to the obliquity of the pelvis in the standing posture, the brunt of intra-abdominal pressure normally falls upon the anterior abdominal wall, symphysis pubis and bladder. In the presence of a deep sac of Douglas, either congenital

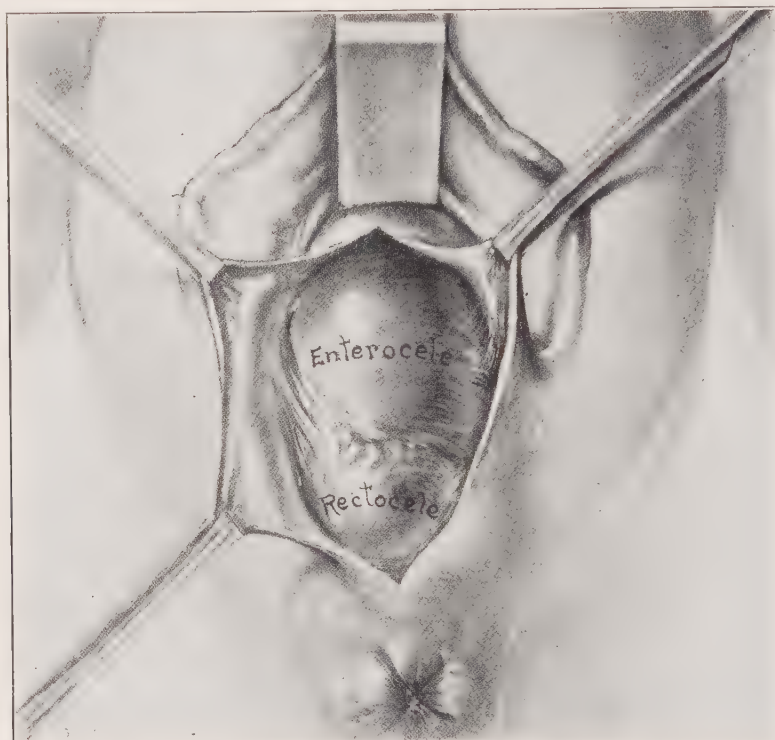


FIG. 260.—ENTEROCELE.

Enterocoele exposed and its relation to the rectocoele. (Courtesy of G. G. Ward in Kelly, *Gynecology*, D. Appleton & Co., New York.)

or acquired, the intra-abdominal pressure is directed on the small intestine in the pouch and falls on the anterior rectal and posterior vaginal wall.

Obliteration of the peritoneal culdesac up to its normal level is essential to cure the condition.

Enterocoele occurs more frequently in women than in men and the sac can be obliterated either below through the vagina or above through the abdomen. In cases without uterine prolapse, Ward obliterates the culdesac from below by the following technic.

Through a median incision of the posterior vaginal wall from cervix to perineum the culdesac is exposed (Fig. 260), and freed by blunt dissection

up to the uterosacral ligaments (Fig. 261). At this level it is closed by ligature suture and cut off (Fig. 262). The uterosacral ligaments are approximated by linen sutures close to the rectum and beneath the ligated stump (Fig. 263). Continuous catgut sutures obliterate the denuded space remaining and a perineorrhaphy completes the operation.

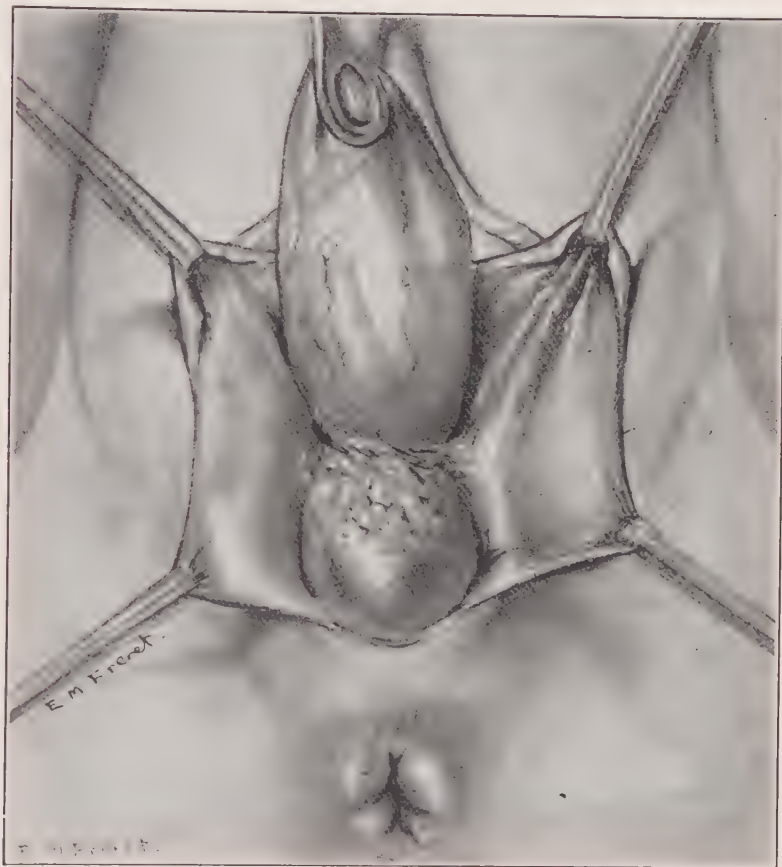


FIG. 261.—ENTEROCELE.

Pouch of Douglas dissected from its vaginal attachments, showing rectum below. (Courtesy of G. G. Ward in Kelly, *Gynecology*, D. Appleton & Co., New York.)

Recently Maes and Rives have developed a plastic operation on the levatores ani and pelvic fascia, on the assumption that complete prolapse of the rectum is due to an abnormally deep peritoneal pouch, combined with relaxation of the lateral ligaments of the rectum, levator and sphincter ani muscles. The procedure is similar to that of Duval and Lenormant who, in 1904, reported three successful cases.

The patient is placed in the lithotomy position and the prolapse reduced. The incision is an inverted Y, its base in the raphé of the perineum and its

arms embracing the anus. The incision is deepened and the anobulbar raphe divided transversely, exposing the external sphincter. Its anterior quadrant is excised and the ends of the muscle united by suture. By deepening the incision, the levator is exposed and separated in the midline and by blunt dissection, with the finger in the rectum as a guide, the rectum is freed as far as the lateral liga-

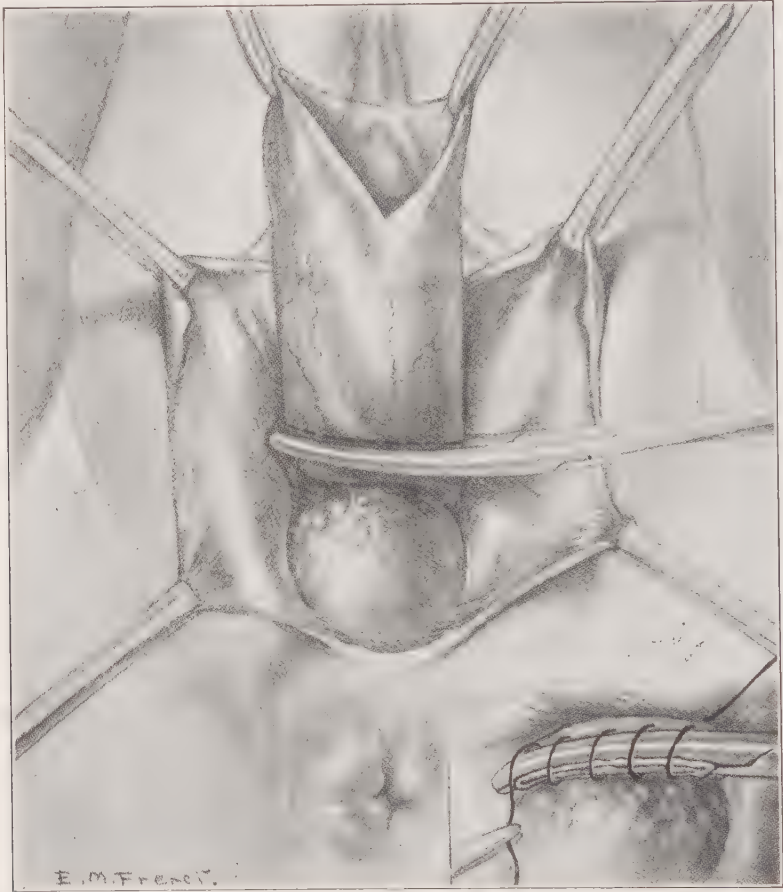


FIG. 262.—ENTEROCELE.

Peritoneal pouch of Douglas dissected out, opened, clamped, and ligated. (Courtesy of G. G. Ward in Kelly, *Gynecology*, D. Appleton & Co., New York.)

ments. The peritoneal pouch, if abnormally deep, is encountered in this situation. It is pushed up carefully, exposing the prostate in front and the rectum behind. The lateral wall of the space is formed by the upper surface of the levator and its fascia. Chromic catgut sutures are introduced to unite the levatores ani and suspend the rectum. Beginning at the apex of the space, the first suture is passed deeply in the levator and its fascia on one side, takes several transverse stitches in the rectal wall at a level 2 to 3 centimeters lower, and

then is carried through the opposite levator at a point corresponding to the point of beginning. In like manner three or four sutures are inserted. The lowermost suture unites the levatores ani but does not include the rectum. The sutures, when tied, close the peritoneal pouch, plicate and suspend the rectum and unite the levatores ani in front of it (Fig. 264).

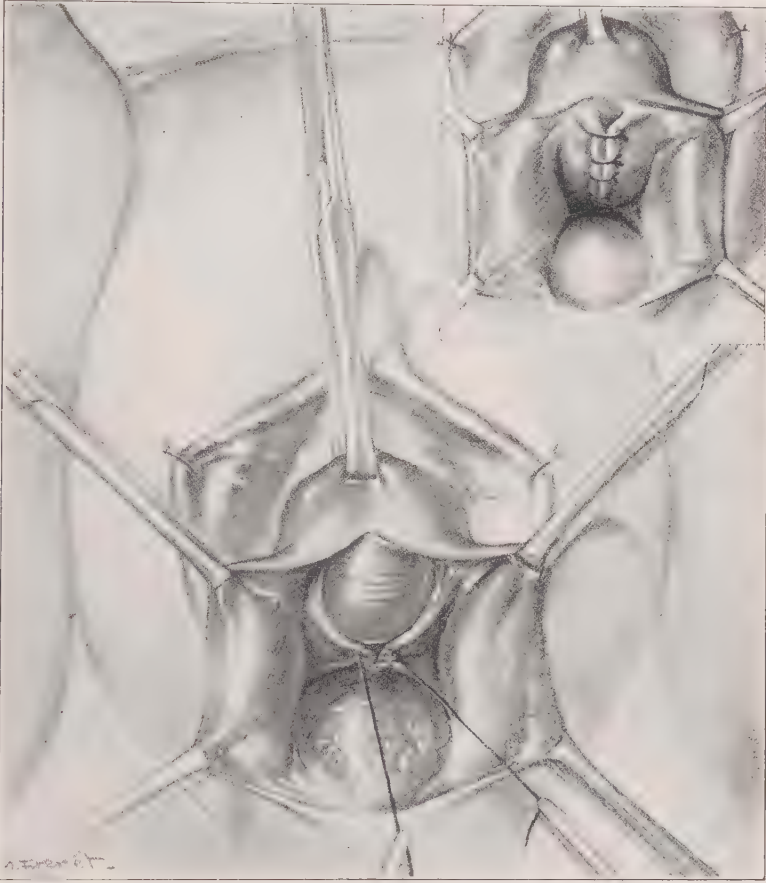


FIG. 263.—ENTEROCELE WITH UTERUS RETAINED.

Uterosacral ligaments united with interrupted linen sutures closing entrance to culdesac; continuous catgut sutures obliterate space. (Courtesy of G. G. Ward in Kelly, *Gynecology*, D. Appleton & Co., New York.)

This technic accomplishes fixation of the anterior rectal wall in uncomplicated cases of complete rectal prolapse of moderate degree. It is particularly applicable in men. In women, where the vagina offers a better avenue of approach to the rectum, some other type of operation is preferable.

Operations through the Abdomen.—*Obliteration of Douglas' Pouch.*—Since publication of the illuminating contribution by Moschcowitz, who con-

ceives rectal prolapse to be a hernia of the sliding type, due to downward pressure of the small intestines in the peritoneal culdesac, obliteration of this pouch of Douglas by suture has grown in favor. Some cases, recurring after other

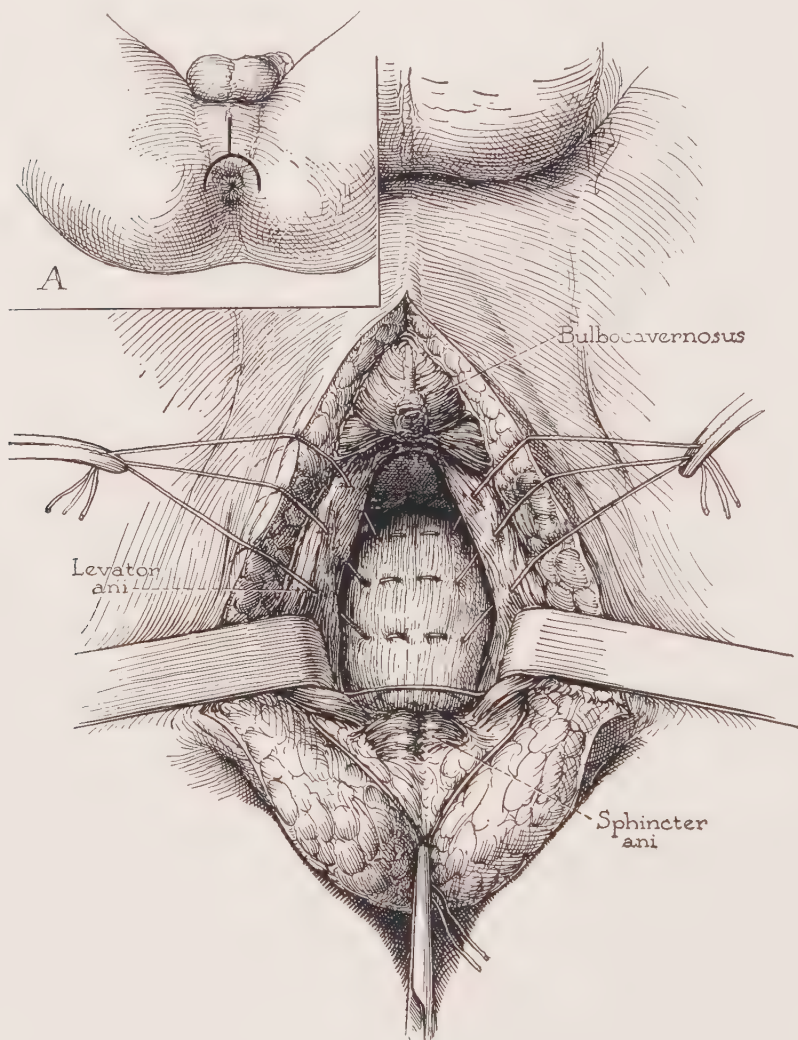


FIG. 264.—COMPLETE PROLAPSE OF THE RECTUM.

Insert A, the incision. The anatomy of the operative field and the method of applying the sutures. (Courtesy of Maes and Rives, *Surg., Gynec., & Obst.*, 1926, Vol. 42, No. 5.)

methods had been employed, are reported as cured by this procedure. It is an operation of too great severity for aged and debilitated patients. Owing to the depth and narrowness of the pelvis, the operation is much more difficult in men than in women. Further, there are obvious objections to sewing the rectum to the bladder. As the condition of abnormally deep culdesac is encountered

more frequently in women than in men, and the technic of its closure differs somewhat in the sexes, we will describe the procedure when the patient is a female.

TECHNIC.—The abdomen is opened by a median incision extending from the symphysis pubis to the umbilicus. The patient is then placed in the extreme Trendelenburg position. The pelvic colon is drawn up taut, reducing the rectal prolapse. Pagenstecher linen or silk sutures are used. From six to eight purse-string sutures are passed circularly around the peritoneum and tied. Effort should be made to include some pelvic fascia in the sutures. The first suture is placed about 1 inch from the apex of the pouch; the others at intervals, so long as they close the peritoneum, until the entire culdesac is obliterated. When the tier of sutures reaches the supravaginal portion of the cervix and body of the uterus, their posterior surface is included in the sutures. Sutures from the side of the pelvis take two or three stitches through the serosa at the sides of the rectum to prevent the possibility of a hernia subsequently.

Care must be exercised to avoid injury of the ureters and internal iliac vessels. The site of the ureters can be marked by introducing ureteral catheters and pulsation indicates the situation of the vessels.

Usually the pelvic colon above the obliterated pouch is not fixed by suture but in women past the menopause ventral fixation of the uterus should be done. This is a valuable safeguard against recurrence. Moschcowitz operated upon eight patients, six women and two men, and reported a perfect anatomical and clinical cure in five. The other three patients were satisfied with the result, but slight anal protrusion occurred on straining.

Sigmoidopexy.—In cases of invagination of the sigmoid, this loop of intestine is usually found at operation to be redundant and its mesentery long and lax. The operation consists in drawing the bowel up and suturing it to the fascia of either the abdominal wall, or the left iliac fossa. Verneuil, in 1889, was the first to perform the operation. It has been employed in a large number of cases, but is now less popular than formerly as fixation in the iliac fossa is preferable.

FIXATION TO ABDOMINAL WALL.—The abdomen is opened by an incision beginning $2\frac{1}{2}$ inches above the pubis and extended upward 4 inches through the outer third of the left rectus muscle. The table is raised to the Trendelenburg position and the intestines, except the sigmoid, walled off with abdominal pads. Next, the parietal peritoneum on the outer side of the wound is incised with a scalpel, a length of $2\frac{1}{2}$ inches, parallel to Poupart's ligament and about 4 inches above it, and its margins separated, exposing the fascia. The sigmoid colon is then drawn upward until the distal bowel from sigmoid to anus is comparatively taut. After determining the site of proposed fixation, three or four Pagenstecher linen sutures are passed transversely through the serosa and muscularis of the pelvic colon, taking in the anterior longitudinal band, and then through the transversalis fascia. The sutures are placed $\frac{3}{4}$ inch apart and after all are placed they are tied so as to draw the bowel in close apposition with

the fascia, but not too tightly lest they cause pressure necrosis of the gut. The sigmoid is thus anchored to the fascia over a space of 2 inches. Closure of the abdominal wound in layers completes the operation. The foot of the bed is kept elevated for ten days and the bowels moved on the seventh day.

In performing sigmoidopexy, some surgeons have anchored the bowel to the parietal peritoneum. As a consequence the sagging bowel draws the peritoneum out in a long band, or becomes detached, and the prolapse recurs. Moreover, the small intestines may become twisted about the band, causing obstruction.

When sigmoidopexy is correctly performed, the bowel remains fixed and the symptoms are usually relieved, although some patients complain of an annoying, dragging sensation at the site of fixation.

FIXATION IN LEFT ILIAC FOSSA.—With the patient in a moderate Trendelenburg position, the abdomen is opened by an incision at the outer border of the left rectus muscle. The pelvic colon is drawn up until the rectum is taut. The site of fixation is as low as possible in the left iliac fossa. The peritoneum is divided by a vertical incision of 3 inches to the outer side of the left ureter and a flap raised on each side. Then the pelvic colon, held taut, is fixed to the iliac fascia and peritoneum over a space of $2\frac{1}{2}$ inches by a triple row of interrupted chromic gut sutures. The first row of sutures attaches the inner edge of the peritoneum to the bowel between a longitudinal band and the mesenteric attachment (Fig. 265); the second row of four or five sutures takes a good bite in the iliac fascia and passes beneath the longitudinal band. After placement they are tied (Fig. 266). The third row of sutures attaches the outer edge of the peritoneum to the bowel outside the longitudinal band. Pennington and others advise dissection of the serosa from the area of bowel to be sutured to aid fixation. Care must be taken to so place the sutures that no kinking or constriction of the bowel lumen will result. Fixation in the iliac fossa is technically more difficult than to the abdominal wall, but it retains the bowel in a more normal position and obviates the possibility of intestinal obstruction.

Amputation.—Amputation of the prolapse is never indicated when an uncomplicated protrusion can be reduced. Conditions justifying amputation are: Gangrene or sloughing of the protruded gut, hypertrophy and adhesions that prevent reduction, the protrusion remaining permanently down; and neoplasms involving the entire thickness of the bowel wall.

The risk of the operation is opening the peritoneal cavity in a field more or less infected. This is naturally greatest in cases of sloughing or gangrene, but is slight in the others, with thorough antisepsis and careful technic.

Although amputation is an operation of necessity and not of choice, very few fatalities have been reported as a result of the procedure. A recurrence may take place, estimated by some writers as high as 50 per cent.

Mikulicz's method with slight modifications is a relatively simple major procedure, hemorrhage is slight and when performed, as it should be, under gas-oxygen or preferably sacral anesthesia, there is practically no operative shock.

The patient is placed in the lithotomy position with half Trendelenburg elevation of the foot of the table to favor recession of the intestines from the pelvis. The protrusion is drawn down with forceps at its apex, thoroughly cleansed and dried, swabbed completely with 7 per cent tincture of iodine, and

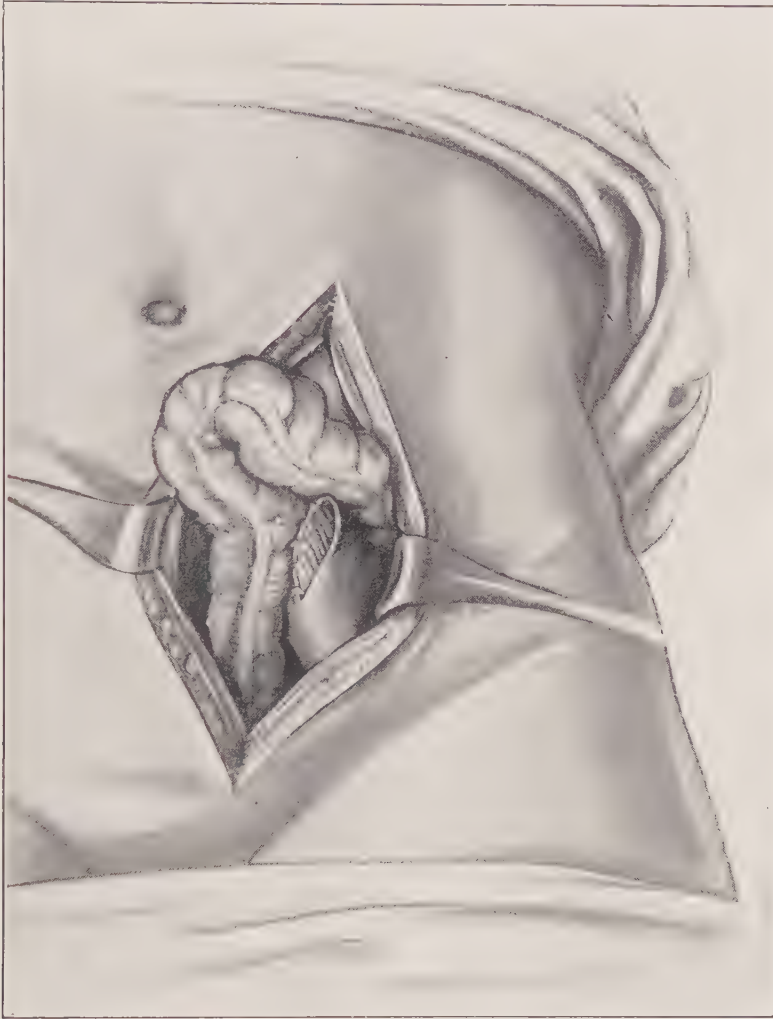


FIG. 265.—SIGMOIDOPEXY FOR PROLAPSE OF RECTUM.

Peritoneum and fascia incised and their inner margin sutured to taut sigmoid. (After Ball.)

enveloped tightly with a dry towel, except the proximal 2 inches. A circular incision, 1 inch from the anal verge, divides the mucosa of the outer cylinder of the prolapse. All bleeding points are then caught and tied. The incision on the anterior surface is then carried through the entire thickness of the bowel

wall, opening the peritoneal pouch. The distal divided segment is next rolled out, freely exposing the intussuscepted inner cylinder. The latter is caught on each side with Allis' forceps and divided transversely on a plane with the first incision, or the gut is drawn taut and clamped as high as possible with a flexible

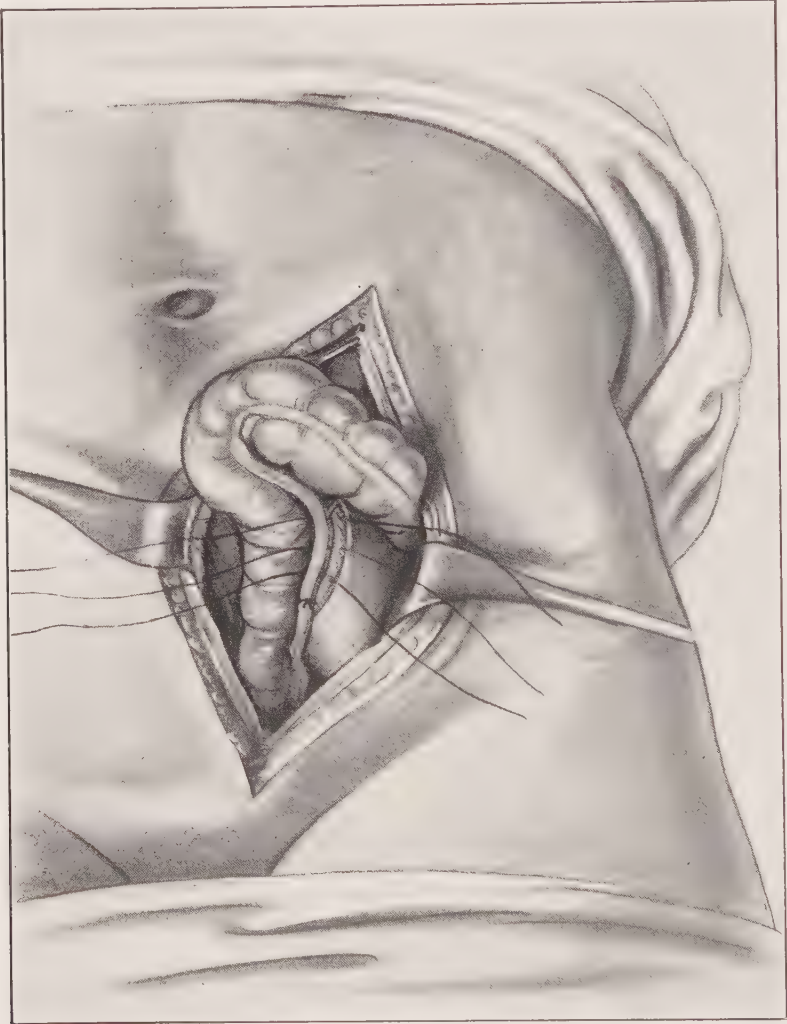


FIG. 266.—SIGMOIDOPEXY.

Longitudinal muscular band of sigmoid sutured to parietal muscle. (After Ball.)

jawed clamp to prevent bleeding from the end of the gut, when it is severed about $\frac{1}{2}$ inch beyond the clamp (J. H. Cunningham).

When the clamp is not used the entire thickness of the inner cylinder is cut through, beginning on its anterior surface, 1 centimeter at a time, and immediately united to the rectum opposite by an interrupted through-and-through but-

tonhole stitch of No. 2 chromic catgut, until the peritoneal pouch is completely closed. The remaining extraperitoneal portions of both cylinders are then quickly amputated through the same plane and the anastomosis is completed by through-and-through sutures. Care must be taken to secure the vessels in the mesentery before dividing them if possible. A running suture of catgut may be used to approximate the mucosa if it gapes too widely. The disproportion between the diameters of the two cylinders may be overcome by dividing the inner gut obliquely or by closing the posterior gap in the outer cylinder by a continuous suture.

A firm rubber tube is introduced about 6 inches through the anastomosis, which is then reduced, and strips of iodoform gauze are packed lightly between the tube and the line of suture. The bowels are confined for seven or eight days, when an enema is given through the tube and the tube withdrawn.

In three cases of extensive chronic recurrent prolapse in old people the author amputated the protrusion by this technic. The anatomical and functional result was very satisfactory in all of them.

Comment on Surgical Treatment of Complete Prolapse.—From a perusal of the operations described, it is evident that the operation must be chosen to fit the case.

Fixation of the rectum to the sacrum is satisfactory for complete prolapse of the rectum of moderate degree in children and in men. In women, having a rectocele or enterocele, anterior rectorrhaphy and rectopexy are also necessary to cure the rectocele, and obliteration of the peritoneal culdesac when enterocele is present. However, the anterior operations alone usually suffice for rectocele and cystocele.

Of the operations through the abdomen, obliteration of the peritoneal pouch by suture seems to be the best procedure for prolapse of the rectum, at the same time doing a ventral fixation of the uterus in women.

For invagination of the sigmoid into the rectal ampulla (sigmoidorectal prolapse), fixation of the pelvic colon in the iliac fossa is the preferable method.

Plastic repair of the anal outlet, when indicated, is a procedure supplementary to these major operations.

Amputation of the prolapsed bowel is an operation of necessity and not of choice in exceptional circumstances.

REFERENCES

- BIER. *Deutsche med. Wchnschr.*, Berl. u. Leipz., 1904, No. 11.
DELORME. *Bull. et mém. Soc. de chir., de Par.*, 1900.
FOWLER, Geo. R. *Med. News*, N. Y. Feb. 27, 1897.
MAES, F., and RIVES, J. D. *Surg., Gynec. & Obst.*, Chicago, 1926, Vol. 42, No. 5.
MIKULICZ, J. *Verhandl. d. deutsch. Gesellsch. f. Chir.*, Berl., Bd. 17.
MONSARRAT, K. W. *Brit. J. Surg.*, Bristol, 1926, Vol. 14, No. 53.
MOSCHOWITZ, Alexis V. *Surg., Gynec. & Obst.*, Chicago, July, 1912.
MUMMERY, J. P. Lockhart. *Diseases of the Rectum and Colon*, 1923.

ROTTER. *Zentralbl. f. Chir.*, Leipz., 1903, No. 39.

SICK. *Zentralbl. f. Chir.*, Leipz., 1909, No. 36.

SPALDING, A. B. *J. Am. M. Ass.*, Chicago, Vol. 79, Aug. 26, 1922.

TUTTLE, J. P. *Diseases of the Anus, Rectum and Pelvic Colon*, New York, D. Appleton & Co., 1906.

WARD, G. G. In H. A. Kelly, *Gynecology*, New York, D. Appleton & Co., 1928.

CHAPTER XXII

DIVERTICULOSIS AND DIVERTICULITIS

Diverticulitis is of relatively frequent occurrence, but it is only within recent years that clinical and pathological study and operative findings have established the condition as a definite disease entity. Diverticula may be single or multiple and are found in all portions of the alimentary canal from the esophagus to the anus. Their site of predilection is the colon, especially the sigmoid flexure. The presence of multiple diverticula of the colon without symptoms is termed *diverticulosis* (Sprague). When secondary inflammatory changes have occurred in the pouches, giving rise to symptoms, the condition is termed *diverticulitis*.

In the large bowel, the diverticula, in about 80 per cent of cases, are situated in the sigmoid area. In 234 cases reported, 118 by Judd and 116 by Masson, the sigmoid was the site in 182, the rectosigmoid in seven, and the rectum in nine. Diverticula are *true* or *false*. The wall of a true diverticulum is made up of all the coats of the bowel. In the false (acquired) variety some of the coats are missing and usually the muscularis is one of these. At first the pouchings are probably mostly true diverticula, but eventually they become hernial protrusions of the mucosa through the muscularis, and their wall is made up chiefly of the mucosa and serosa.

The number of diverticula in an individual case may be few, but usually they are very numerous, as many as four hundred having been observed by Hansmann in the intestines of the same subject at autopsy. The sigmoid is frequently studded with them. The diverticula are nubbins shaped, 0.5 to 3 centimeters or more in diameter, and may be elongated, like an appendix, sometimes to over 2 inches in length. They are distributed mainly along the sigmoid, between the longitudinal bands and mesentery and on its convex border. Frequently they invaginate into the appendices epiploicæ which are points of diminished resistance. Their other site of occurrence is between the folds of the mesentery at the sites where the vessels perforate the bowel wall. The pouches usually communicate with the bowel lumen by a narrow opening. Consequently they empty themselves with difficulty and stercoroliths tend to form. Less frequently the opening approaches the diameter of the pouch itself and communication with the bowel lumen is free.

Etiology.—Diverticulitis is largely a disease of late middle life, although there are several authentic cases reported in children at the sixth and seventh years. The majority of cases occur in the fifth and sixth decades, but in Pennington's collection of 133 cases, nineteen were less than forty years of age. The

incidence in the sexes is approximately three males to one female. Several theories have been advanced as to the primary cause of diverticula formation:

(a) Hernial protrusions following the emerging veins (Graeser), denied by Sudsky.

(b) Increased intracolonic pressure causes herniation through weak points in the musculature as a result of irregular contraction (Keith).

(c) "The most that can be said is that for some cause, a weakness exists in the intestinal coats, and by reason of this weakness, a pouching of the coats takes place when any undue pressure arises" (Hartwell and Cecil).

(d) Erdmann is inclined to the view that they are of congenital origin.

Although the true etiology of acquired diverticula is not known, it would seem to be a reasonable assumption that several factors are operative, but a bowel wall, congenitally weak, especially in its musculature, is the most im-

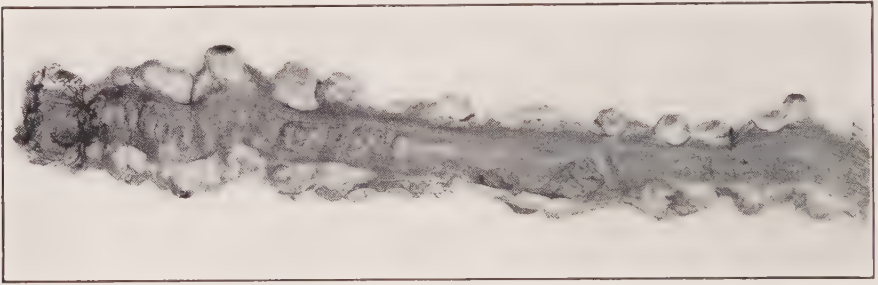


FIG. 267.—DIVERTICULOSIS OF COLON.

Photograph of serous surface. (City Hospital Museum, New York.)

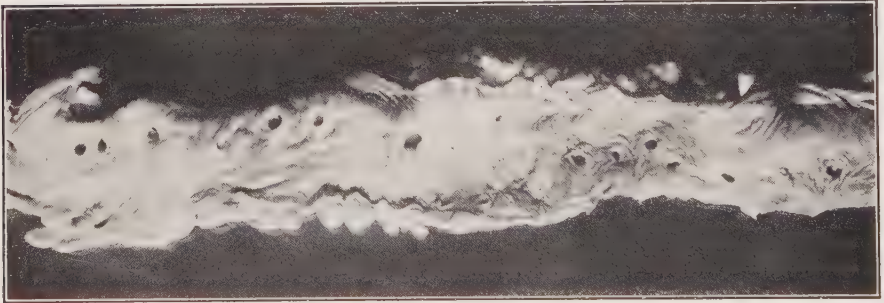


FIG. 268.—DIVERTICULOSIS OF COLON.

Photograph of mucosal surface, same specimen as in Fig. 267.

portant predisposing factor and that increased pressure within the bowel acts as a prominent exciting cause. A considerable proportion of these patients are constipated, resulting in pressure by the retained feces and gas distention. Opposed to this is the much more frequent occurrence of constipation in females than in males, while the opposite obtains in diverticulitis. There is no doubt of the

rôle of constipation in producing many of the inflammatory changes in the diverticula. The infrequent association of diverticula with rectal stricture in which intrasigmoidal pressure is increased, is noteworthy. A majority of the patients are or have been obese.

Pathology.—The pathologic changes occurring in diverticula are *acute*, or more commonly *chronic*. Retained hardened feces and rarely a foreign body



FIG. 269.—DIVERTICULOSIS OF SIGMOID AND COLON.
Male, aged fifty-eight. (Radiogram by Wm. H. Stewart.)

are responsible for the inflammatory processes set up within the pouches. In the *acute* type, the inflammatory process is analogous to acute appendicitis. Individual diverticula may be found in all stages of inflammation, acute catarrhal, exudative, abscess formation, or gangrenous with perforation. A single pouch may be involved but its removal gives no assurance that others will not become infected later, and this has actually happened in a number of cases. Recession of the inflammation may occur but there is usually a relapse.

In the majority of cases the inflammatory process is chronic, lasting months

or years, and many diverticula are involved. Due to the passage of bacteria and toxins through the ulcerated mucosa of the diverticulum, irritation is set up in the extramucosal coats of the bowel, especially in the subserous fat, with resulting round-cell infiltration and fibrous tissue formation. As the process is chronic, the thickening of the bowel wall may be enormous and cartilaginous in character, giving rise to the tumor mass so often felt in these cases. Occasionally, due to the bulk of the tumor, kinks of the bowel may occur. In reality this tumor

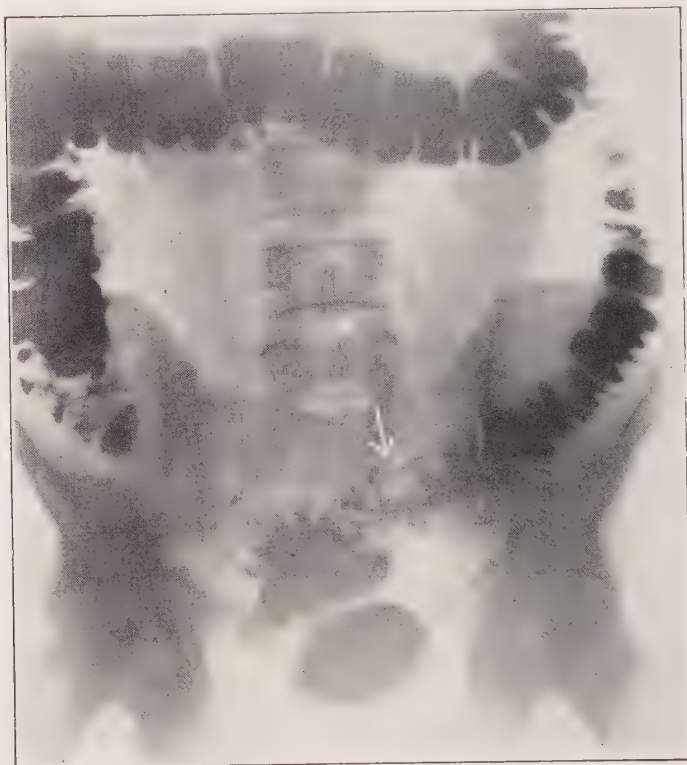


FIG. 270.—MULTIPLE DIVERTICULA OF ILIAC COLON (DIVERTICULOSIS). Male, aged fifty-one, no symptoms. (Radiogram by Wm. H. Stewart.)

formation is the result of a peridiverticulitis. The diverticula, many of which contain fecal matter, become imbedded in the tumor mass, which may also be interspersed with small chronic abscesses. The abscesses are seldom so acute that they rupture and produce a spreading peritonitis; but abscess formation and localized peritonitis are common, producing adhesions to adjacent viscera, especially to the bladder, but also to other segments of the bowel, frequently resulting in fistulæ into these organs. Rarely, adhesions form to the abdominal wall and open on the surface as chronic suppurating sinuses. The changes produced in the mesentery are septic enlargement of the lymphatic glands, infiltration and thickening, and abscess formation. Thickening of the mesosig-

moid together with infiltration of the bowel wall produces a mass frequently impossible to differentiate, even at operation, from carcinoma without the aid of the microscope.

Formation of fibrous tissue in the bowel wall with its inherent nature to contract, results in constriction of the intestinal lumen into a stricture, usually tubular and of the chronic obstructive type, although complete stenosis seldom occurs. The surface of the stricture is smooth, and usually its lining mucosa is



FIG. 271.—CHRONIC DIVERTICULITIS OF SIGMOID WITH OBSTRUCTION. RELIEVED BY COLOSTOMY.

Male, aged fifty-six. (Radiogram by Wm. H. Stewart.)

not ulcerated as it is in cancer, but stercoral (pressure) ulceration has been observed above the stricture.

A secondary development of cancer may take place on the base of the chronically ulcerated diverticula as occurred in five of twenty-one cases reported by Giffin, and in four of Erdmann's fifty-two operated cases. The malignancy may be coincident, but it seems more probable that in the majority of cases it is secondary to the chronic irritation.

Symptoms.—Diverticulosis usually occurs in constipated subjects but may be otherwise symptomless for years and only be discovered accidentally in a routine x-ray examination of the gastro-intestinal tract, during operation for some other abdominal condition, or at autopsy. On the other hand, the symptoms of diverticulitis are either acute or chronic.

In the *acute* cases, with abscess formation, the symptoms resemble those of acute appendicitis transferred to the left side. There may be nausea and vomiting, pain in the left lower quadrant, raised temperature and pulse, local tenderness on pressure and finally a palpable mass in the left iliac fossa. The blood-picture is that of an acute infection. If the lesion is low in the sigmoid rectal palpation may elicit tenderness or detect a swelling.

Subacute or *chronic* cases run a course of months or years. The majority of these patients are well nourished or have been stout, with only a few pounds weight loss. Constipation is usual and during exacerbations symptoms of mild intestinal obstruction may occur; occasionally nausea and vomiting, and short periods of diarrhea. Pain is a rather constant symptom. It varies from slight abdominal unrest to severe colic in the lower abdomen, and in women especially, it may be referred to the pelvis. Evening temperature is frequently elevated one or two degrees. The leukocytes may number 12,000 to 15,000 with relatively increased polymorphonuclears. A mass is frequently palpable in the left lower quadrant, larger than in cancer. The mass is apt to be fixed and is rather tender. Bimanual examination, pelvic in women and rectal in men, helps to define its extent. In women, frequently associated pathology in the left tube and ovary may increase the difficulties of diagnosis. Proctoscopy should always be done. Adhesions or tumefaction may prevent introduction of the tube into the sigmoid. It is of great negative value, however, in showing an intact mucous membrane and the absence of bloody purulent discharge. It is exceptional to diagnose diverticulitis by proctosigmoidoscopy but it will usually demonstrate a carcinoma in this situation. However, the author recently demonstrated in a man the opening of a diverticulum at the level of $6\frac{1}{2}$ inches from the anus in the right side of the bowel wall. An x-ray plate showed many diverticula of the sigmoid.

In another case, a welling up of pus into the tube passed into the sigmoid gave valuable evidence of diverticulitis, which was confirmed at operation the next day.

Diagnosis.—*Roentgenograms.*—X-rays cannot be used in acute cases, but in the chronic variety they usually furnish a positive diagnosis. In diverticulosis, ingested bismuth may be demonstrated in the pouches two or three days later and may remain for several weeks. Plates taken two or three days after a barium enema, thus allowing time for the evacuation of most of it, give the most characteristic shadows. After massive diverticulitis has occurred, x-rays show spasm, thickening and constriction of the bowel lumen. Complete obstruction, however, rarely takes place.

Passage of gas or feces per urethram, with or without the discovery by cystoscopy of an apparently inflammatory fistulous opening in the bladder, is proof positive of vesico-intestinal fistula.

Differential Diagnosis.—The mass of chronic diverticulitis is to be distinguished chiefly from malignancy of the sigmoid, the ratio of incidence being about one to seven. A history of previous attacks of pain with recovery or

remission over a long period point to diverticulitis. Carcinoma produces greater loss in weight and strength, pain is notably absent until late in the disease, blood in the stools is characteristic, the tumor is not tender, proctosigmoidoscopy yields evidence of ulceration, x-rays do not show diverticula, unless possibly the carcinoma has developed upon diverticulitis; temperature is normal, and the blood-picture is that of secondary anemia without leukocytosis. The opposite prevails in diverticulitis. The possibility of both conditions coexisting must be borne in mind, and in the event that a cancer of the sigmoid has perforated, the clinical picture of the two conditions is practically identical. There is no doubt that many reported instances of "cured" carcinoma of the sigmoid following colostomy were cases of chronic diverticulitis with tumor formation.

Prognosis.—The rarity of diverticulitis in comparison to the number of cases presenting diverticula, is convincing evidence that the prognosis of diverticulosis is favorable. In the acute cases the prognosis with early operation is good, while in the chronic cases it varies with the extent of involvement and type of operation performed.

Treatment.—It seems quite certain that careful *prophylactic treatment* will prevent the development of

diverticulitis in a large proportion of cases having the condition of diverticulosis. Roberts treated the majority of a series of twenty-four cases medically with "exceedingly satisfactory" results. Laxatives which produce irritating fluid stools should be avoided. The bowels are moved by a vegetable diet, augmented by agar and mineral oil, and enemas of warm oil, if necessary. One ounce doses of bismuth or barium in emulsion or buttermilk may be taken weekly or biweekly for a long period to fill the pouches with a bland, inert substance instead of the irritating feces. In some cases the diverticula are more readily filled when the bismuth is given by enema. To allay the colonic spasm,



FIG. 272.—CHRONIC DIVERTICULITIS.

Rectal lumen nearly obliterated and its wall markedly thickened. Aged female. Clinical diagnosis, carcinoma; postmortem, chronic diverticulitis. (City Hospital Museum, New York.)



FIG. 273.—CARCINOMA OF THE COLON DEVELOPING IN THE PRESENCE OF DIVERTICULA.
(Rankin, *Surgery of the Colon*, D. Appleton & Co., New York.)

at times associated, bromids and belladonna are used, but luminal in $\frac{1}{2}$ grain doses thrice daily is more effective. In some cases, under medical treatment, the acute attack subsides and resolution occurs even in those that have gone on to abscess formation, but recurrence is usual.

Surgical Treatment.—Immediate surgical intervention is indicated in acute cases, evidenced by perforation and abscess formation or peritonitis; or adhesions to the bladder, threatening perforation, as shown by frequent, burning, urination and recurrent “bearing-down” pain deep in the pelvis. Surgery is less urgent in the chronic cases but is indicated (*a*) when attacks of pain and tenderness persist, despite careful management, (*b*) threatened obstruction, unusual but which may occur especially at the rectosigmoidal junction, and (*c*) a palpable tumor, especially if the symptoms are persistently progressive and are accompanied by a discharge of blood. The latter suggest forcibly that the diverticulitis has undergone a malignant change or that the tumor was malignant from the beginning. Under these circumstances surgery is the only treatment.

The type of operation is determined by the pathology present and the judgment of the surgeon. In the acute cases, when the inflammation is limited to a single or few diverticula and there is no mass formation, the treatment is much the same as for analogous conditions of the appendix. Ablation of the diverticula and attempts at repair of the perforation, with drainage, are frequently successful. For the frank abscess, free drainage with the least amount of handling is indicated. Both of these acute types are prone to be followed by a fecal fistula which tends to heal spontaneously in a few weeks or months. When the abscess is situated in the mesosigmoid, Erdmann recommends splitting the peritoneum on both sides parallel to the vessels to promote free drainage from the fat of the mesentery and to diminish the chances of vicious retroperitoneal lymphatic absorption.

In the chronic cases the operative treatment has to do with a mass which partially, but seldom completely, obstructs the bowel. The ideal treatment is resection of the mass and end-to-end anastomosis, with or without a temporary cecostomy. Unfortunately primary resection is feasible only when the involvement is limited to the apex of the sigmoid. Mummery resected the sigmoid in ten cases, eight with immediate end-to-end anastomosis (two deaths) and two colostomy (one death).

A gentleman consulted me recently for progressive constipation. At Cape Town, South Africa, six months previously, resection of 6 inches of the sigmoid with immediate anastomosis had been done for diverticulitis. Proctoscopy showed at the site of suture, a constriction of $\frac{1}{2}$ inch diameter without ulceration (Fig. 239). With careful attention to bowel function, patients with this sort of operative narrowing of the bowel can be carried along in comfort.

On the other hand, colostomy, proximal to the mass, is the operation most applicable in the vast majority of cases. It is the safest operation, has practically no mortality, and can be performed readily under local anesthesia. After the fecal current is thus diverted, the symptoms subside and the mass shrinks as a result of absorption of the products of inflammation. At this stage, resection may be done more safely and with better prospect of success. The colostomy should be some distance from the mass. The transverse colon is the preferable site.

Infection of a virulent type frequently follows major intra-abdominal opera-

tions on the sigmoid colon, more especially when the tissues have been subjected to chronic infection as in diverticulitis. For this and other valid reasons, instead of primary resection, a resection by the three-stage Mikulicz method is preferable. It requires more time for convalescence, but has a very low mortality and yields excellent results.

Operations designed to *short-circuit* an obstructive diverticulitis mass are seldom feasible and the new stoma is liable to be involved in an inflammatory contraction. Nevertheless, a physician aged seventy-five, under the author's care for several years for occasional attacks of diverticulitis, three years ago while in another city developed acute and complete intestinal obstruction. The cecum was joined at once to the sigmoid below the obstructing mass, and the patient has enjoyed excellent health ever since.

VESICOSIGMOIDAL FISTULA.—Because of its proximity, the sigmoid affected with diverticulitis is prone to attach itself to the bladder. Perforation at the site of adhesion occurs by ulceration or the rupture of an abscess. Adhesion is apt to occur near the base of the bladder and over a broad area, making the separation difficult or impossible. In these circumstances, with pneumaturia, fecaluria and cystitis, prompt diversion of the fecal stream by a colostomy, well above the diverticulitis, is indicated.

The efficacy of this method is illustrated in the case of a gentleman, aged fifty-two. For eleven years he had symptoms of partial obstruction in the pelvic colon, periods of slight elevation of evening temperature and general malaise, and the weight had fallen from a normal of 180 to 131 pounds. Latterly, frequent and urgent urination was a marked symptom and finally flatus and feces were passed per urethram. The thin stools contained no blood. The proctoscope was stopped 6 inches above the anus by a constriction which would not admit a tube of $\frac{1}{2}$ inch diameter. No ulceration of the bowel mucosa was observed. A tender mass was palpable in the left iliac fossa. X-rays showed almost complete occlusion of the sigmoid (Fig. 190).

At operation, I found the middle third of the sigmoid hard and nodular and its mesentery short, broad and infiltrated. The mass was less fixed than a cancer of corresponding size would be. The lower end of the mass was fused into the fundus of the bladder over an area 2 inches broad. Following a colostomy in the transverse colon (Feb. 8, 1926), and appropriate local treatment, all of the symptoms subsided, he has regained 35 pounds in weight; analysis shows normal urine and he has followed his profession as a lawyer without interruption for almost three years.

REFERENCES

- BEER, E. *Am. J. M. Sc.*, Phila., 1904, 128: 135-145.
 ERDMANN, J. F. *Am. J. Obst. & Gyn.*, 1926, Vol. 11, No. 5.
 GRAESER. *Verhandl. d. deutsch. path. Gesellsch.*, 1899, 1900.
 GRIFFIN, H. Z. *J. Am. M. Ass.*, Chicago, Sept. 14, 1912, p. 864.
 ——— *Ann. Surg.*, Phila., 1911, 53: 533-537.

- HARTWELL, J. A. and CECIL. *Am. J. M. Sc.*, Phila., 1910, III: 174.
JUDD and POLLOCK. *Ann. Surg.*, Phila., Sept., 1924.
KEITH. *Brit. M. J.*, Lond., 1910, p. 376.
MASSON. *Canad. M. Ass. J.*, 1921, II: 106.
MAYO, W. J. *J. Am. M. Ass.*, Chicago, Sept. 8, 1917, p. 781.
MUMMERY, J. P. Lockhart. "Diverticulitis and Its Surgical Treatment," *Lancet*,
Lond., Feb. 27, 1926, p. 437.
ROBERTS, Dudley. *Surg., Gynec. & Obst.*, Chicago, Feb., 1916, pp. 211-217.

CHAPTER XXIII

MEGACOLON

"Megacolon" and "giant colon" refer to chronic dilatation of the colon, whether congenital or acquired. Hirschsprung's disease and idiopathic dilatation of the colon are terms applied to a congenital condition, characterized by dilatation of the whole or part of the colon with hypertrophy and secondary degenerative changes in the wall of the affected portion, but usually without demonstrable organic obstruction at operation or necropsy.

Although a score of isolated cases were noted in the literature, beginning with Parry's in 1825, and Bright in 1838, who operated upon a patient with this condition, the megacolon received scant general attention until Hirschsprung's classic papers appeared in 1886-1888. Mya, in 1894, studied the pathology exhaustively. Hirschsprung, of Copenhagen, described the disease as a "condition of congenital high-grade dilatation of the colon, with thickening of all its tunics, especially the tunica muscularis, and retention of large quantities of fecal matter."

Occurrence.—Although only approximately five hundred cases have been reported, doubtless many unreported cases occur. Improved methods of diagnosis, especially the x-ray examination after a barium clysm, will doubtless reveal many unsuspected cases in children and treatment instituted at an early stage of the disease may result in regression or clinical cure in some cases.

From 1868 to 1912, Barrington-Ward found autopsy records of nineteen cases in the London Children's Hospital, sixteen males and three females. In 1915, Smith collected 392 cases from the literature. In 1908, Finney reported eleven cases occurring at the Johns Hopkins Hospital, four of the patients being colored.

The sex ratio in children is approximately six boys to one girl, and in adults it occurs as often in men as in women. In 152 cases of all ages collected by Pennington, 119 were males and thirty-three females.

Age.—The youngest instances were in the newborn, and the oldest was seventy-eight years of age. In Patel's series of 223 cases, 150 patients were under fifteen years and seventy-three older. The combined figures of Patel, Pauchet, Barjon, and others showing the age incidence are tabulated on the following page.

Etiology.—The megacolon seldom has other congenital anomalies associated with it. However, in some cases other congenital anomalies have been noted at autopsy, as multiple stenosis of the gastro-intestinal tract, eventration of the diaphragm or absence of other abdominal viscera. The etiology is obscure. Many

<i>Years</i>	
Under 1	44
1-5	85
6-10	57
11-20	78
21-30	67
31-40	29
41-50	16
51-60	25
61-70	12
Over 70	7
TOTAL	420

theories of causation have been advanced. Hirschsprung accepts a congenital enlargement and hypertrophy of the bowel which, with the onset of bowel activity after birth, furnishes the cause for the coprostasis and subsequent injuries. He considered the basic cause "either an anomaly of development or a pathologic fetal process."

Moreover, considerable confusion is injected into the etiology due to the fact that cases of obstipation and intestinal stasis with ectasia and thinning of the bowel wall are reported as megacolon. No single theory explains in a satisfactory way the origin in all of the cases, but the majority of writers concur in Hirschsprung's hypothesis.

Barrington-Ward has collected and classified the various hypotheses advanced as:

A. Mechanical

1. An abnormally long mesentery, permitting torsion of the pelvic colon
2. Increased length of the intestines, especially the pelvic colon, which throws the bowel into loops and causes kinking and obstruction
3. Atresia of the rectum and anus
4. Valve formation
5. Distention of pelvic colon with meconium at birth, and valve action
6. Neuromuscular defect of a segment of the intestine

B. Neuropathic

7. Paralysis of a segment of intestine
8. A lesion of the sympathetic system
9. Reflex spasm of the sphincters due to anal fissure

C. Inflammatory

10. Colitis becoming chronic (consequent, not causal—author)

D. Congenital

11. Anomaly of development (dilatation and hypertrophy, congenital)
12. Dilatation congenital, hypertrophy secondary
13. Hypertrophy congenital, dilatation secondary

Several of the theories suggested are vitiated by the fact that autopsies in thirteen of fifteen cases reported by Barrington-Ward demonstrated the rectum also to be hypertrophied or dilated or both.

Obstruction of the bowel by stricture, by angulation, valve formation or torsion (volvulus), or spastic contraction of the anus has been observed in some cases, but in the vast majority no such mechanical interference has been found at operation or necropsy.

In Mummery's series of one hundred collected cases, obstructive factors were found in twenty-three:

<i>Causes of Obstruction</i>	<i>Cases</i>
Congenital stricture of rectum.....	11
Chronic volvulus of the sigmoid flexure.....	7
Angulation	2
Slight rectal narrowing.....	2
Congenital stricture of the sigmoid flexure.....	1
No obstruction found.....	77
TOTAL	100

Hirschsprung recognized two types of the disease: Infantile or true megacolon, occurring in children; and pseudomegacolon in adults. In recent years a routine x-ray examination of the gastro-intestinal tract of children suffering with digestive disturbances and constipation has demonstrated elongated, dilated and misplaced loops of the colon, especially the sigmoid flexure. It may well be that many of the cases of pseudomegacolon in adults develop from a latent congenital defect. An obstruction is found rather frequently in the adult type. The stress and strain of the active period of life, coupled with intestinal stasis in later years, would seem to be important factors in stimulating the congenital defect.

All that can be said of the infantile cases at least is that there is a congenital defect of the colon expressed in hypertrophy and dilatation. That this may persist is illustrated convincingly in the case of Maurice Richardson.

Familial Tendency.—A few instances have been reported as occurring in brothers (Hirschsprung, Machell), twins (Pepper), father and daughter (Finney).

Pathology.—The ectasia may involve the entire colon, a segment only, or several segments separated by apparently normal bowel; or exceptionally only a portion of the circumference. The disease entity usually is limited to the colon and rectum, the process ending abruptly at the ileocecal valve.

The sigmoid is the segment most frequently involved. In Neugebauer's 169 cases, the sigmoid alone was affected in seventy-four. In an analysis of 104 cases, Puls found the sigmoid alone involved in 35 per cent, the sigmoid alone or with other segments in 84 per cent, and the entire colon including the cecum in 27 per cent.

Mummery states that the portions of colon affected in ninety-two cases were:

Sigmoid	51
Whole colon	20
Hepatic or splenic flexure to rectum.....	13
Hepatic flexure to sigmoid.....	1
Cecum to splenic flexure.....	4
Transverse colon	2
Descending colon	1

In nine of the twenty cases of total ectasia, the rectum was also involved.

The dilatation may end abruptly or the transition from pathologic to normal bowel may be gradual or funnel-shaped. The pathologic changes consist in an extreme dilatation, hypertrophy and lengthening of the involved portions of the colon, usually with no apparent mechanical obstruction on opening the bowel. The diameter of the bowel may be 4 to 6 inches, even in children, and in one of Hawkins' cases the circumference of the dilated portion was 43½ inches. As a rule, the sigmoid presents as an enormous loop, its apex directed upward, less frequently in multiple loop formation. This may result in a valvelike formation at the lower end of the dilatation which is probably not, as considered by some, an etiologic factor, but is produced by kinking of the enlarged bowel.

As a result of the long-continued stretching, tæniæ and haustrations disappear, and the affected bowel presents a peculiar smooth whitish appearance like the stomach. The bowel wall is firm and stiffened, has a leathery feel and, due to hypertrophy, it may be thickened from five to ten fold, being ¼ inch or more in thickness. Rarely, as a result of connective-tissue replacement of the musculature, through the pressure of gas and feces, the dilated gut wall is thinned out, as occurred in Cadwallader's case.

Hypertrophy, which invariably accompanies the dilatation, involves all the tunics of the bowel. The essential lesion is hypertrophy of the muscularis and especially the inner circular coat.

The mucous membrane shows few primary changes but the dilatation may partially obliterate its normal folds. The submucosa usually undergoes inflammatory thickening.

The blood-vessels dilate and their walls may be thickened. The nerves show no constant or characteristic change.

The mesocolon usually presents a marked lengthening but with normal thickness. In some cases, it is thickened with enlarged lymph-nodes, and dilated lymph- and blood-vessels.

The retained feces frequently produce *secondary changes* of chronic inflammatory character in the mucosa. Stercoral ulceration has been noted in approximately 12 per cent of cases. Peritoneal adhesions may ensue and very rarely perforation has occurred.

Contents.—The fetid contents retained in the involved bowel are mainly gas and feces. The latter may be semifluid but are usually dark, dry, hardened

masses. When impregnated with phosphates they form fecaloma sometimes weighing many pounds, 4 pounds in Graham's case and 22 in Riche's.

Symptoms.—The dominant symptoms are intractable constipation and tremendous enlargement of the abdomen. In the vast majority of cases the symp-

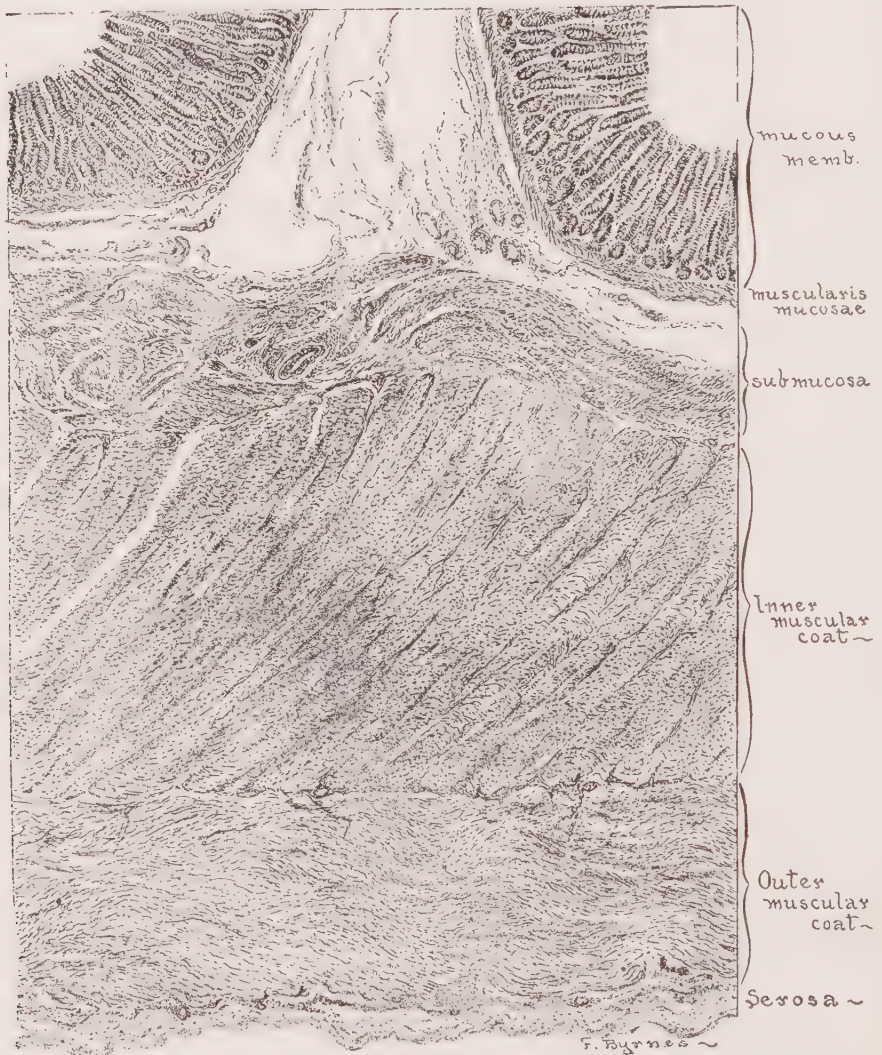


FIG. 274.—SECTION THROUGH WALL OF HYPERTROPHIED COLON (MAGNIFIED 12 DIAMETERS).
(Rankin, *Surgery of the Colon*, D. Appleton & Co., New York.)

toms date from birth. In Löwenstein's series of eighty-eight cases, the onset was from birth in fifty-five, up to one year, thirteen; from one to twenty years, eleven; over twenty years, nine.

Delay or difficulty in passing the meconium may be the first symptom.

Constipation usually occurs first, distention soon after. When the little patients survive, the constipation is markedly aggravated. The bowels may act once or twice weekly, but in several adult patients the evacuations have been at long intervals—two months (Judd), seven months (Tronnes), in spite of medication.

Meanwhile, apart from the inconvenience of the distention, these adult patients may feel comparatively well. The long retention usually ends either spontaneously or as a result of medication, in many copious fetid stools (fifteen to twenty) in one day. With the enormous evacuations, the abdominal distention may recede rapidly but not entirely disappear, but usually recurs to its former size in a few days.

Abdominal distention, the other characteristic feature, appears soon after the constipation. Children present a pot-belly appearance. The distention may be startling, as in Formand's patient, aged twenty-nine, who exhibited himself as the "balloon man." A girth of 23 inches has been noted in an infant aged six months; 47 inches in a boy of eleven years, and over 4 feet in adults.

Borborygmi are sometimes prominent and flatus of foul odor may be passed freely.

In cases of long standing, symptoms of stasis toxemia are usually well marked, namely, anemia, emaciation, staining of the skin, lethargy, foul breath, cold extremities and low blood-pressure.

Vomiting is a late manifestation and is either reflex from toxic absorption or due to obstruction. Pain is not a prominent symptom but is severe if acute ileus develops. Then the hypertrophied loop exhibits waves of visible peristalsis.

Pressure of the distended gut on other organs is manifested by elevation of the diaphragm, displacing and hampering the functions of the lung and heart. The cardiac apex may be in the second or third intercostal space, or even displaced to the right. Compression on the ureter has resulted in hydronephrosis, and albuminuria is frequently present. Pressure on the deep prevertebral veins has given rise to dilatation of the superficial veins of the lower abdominal wall; and on the iliac trunks, has caused edema of the lower extremities.

The coprostasis frequently terminates in acute obstruction due to valvular kinking, torsion or volvulus.

A number of examples of megacolon have occurred in demented. Infants may exhibit rachitic symptoms, delayed dentition and late closure of fontanelles. The symptoms of acute or chronic colitis appear as stercoral diarrhea. The course of



FIG. 275.—HIRSCHSPRUNG'S DISEASE.

Boy aged two years. (Bolling, *Surgery of Childhood*, D. Appleton & Co., New York.)

the disease is usually chronic and irregular, the symptoms varying with the response to the treatment instituted.

Diagnosis.—A history from birth of intractable constipation, with large periodic evacuations; gaseous distention and protrusion of the abdomen, and symptoms of stasis toxemia are strongly suggestive of megacolon, although less suspicion would attach to cases occurring in later life. To inspection, the abdomen is usually uniformly distended, but the tumefaction may be asymmetrical; the skin is tense and shiny, the veins may be prominent; rarely edema is present, and sometimes visible peristalsis obvious through the thinned abdominal wall. The tense distention may frustrate palpation but in favorable cases the involved segment may be felt and moved freely in the abdomen. This is especially true in adults, with fecal masses situated usually in the lower quadrants of the abdomen. Rankin, in a child of six years, by digital pressure produced dents in the masses which gave a cue to the correct diagnosis of fecal impaction. The abdomen is not tender on palpation unless there is a complicating inflammation, and deep manipulation does not elicit pain.

Percussion shows a uniform tympany of the abdomen, but if the gas can be evacuated areas of dulness may be mapped out. Owing to the elevation of the diaphragm, liver dulness is diminished or absent.

Digital palpation of the rectum should be routine. The rectum may be normal, gas and feces absent, or involved in the disease process and impacted. Anal spasm (fissure), atresia or an annular (diaphragm-like) stricture have been encountered. If the impacted bowel can be evacuated, proctoscopy will reveal the condition of the mucosa, obstruction, if present, at the rectosigmoidal juncture, and sometimes show the capacious sigmoid as a huge sac within the abdomen.

Roentgenograms after a barium clysma furnish the most convincing confirmatory evidence of the pathologic dilatation and the colonic segments involved.

This procedure is of the highest value in the diagnosis of the congenital cases and furnishes a diagnostic picture in children. In adults, the x-ray not only outlines the colon and rectum but helps to differentiate other lesions, as chronic infections of the colon and obstructing malignant disease or stricture. In children megacolon superficially may resemble tuberculous peritonitis or tabes mesenterica. Elevation of temperature and ascites serve to distinguish the latter.

Prognosis.—Patients with megacolon have, in general, an uncertain prospect of recovery. When the disease is congenital or manifests itself soon after birth, according to Weil, "in most instances, the children succumb to an extreme state of cachexia and emaciation, with all the signs of very pronounced marasmus."

Obstruction, ulcerative colitis and intercurrent disease are the common lethal factors in infants. Yet many infants who survive may, with due care, live beyond the sixtieth year. The cause of death in thirty-one adults is given by Weil as:

Intestinal obstruction, thirteen; peritonitis, eight; acute colitis and profuse diarrhea, ten.

Treatment.—*Medical.*—Although cure is scarcely to be expected, medical treatment should be tried before surgical intervention. Patients under five years of age are a poor surgical risk and conservative treatment may strengthen and prepare them for later operative intervention.

The diet should be soft and non-irritating, with the minimum of fermentative substances—in general, a bland diet. The newborn should be nursed as long as possible. A certain few cases of functional obstipation do better on a dietary containing considerable cellulose—green vegetables, fruit, etc., or a change in diet may be in order.

Drugs are of little avail. Strong cathartics cannot be given over long periods because of their injurious effects. Mild laxatives—agar, mineral oil, cascara, phenolphthalein and salines, especially magnesium sulphate—on account of their softening effect on the hard fecal masses are an aid to the enema treatment. Atropin and belladonna are useful in cases of spasm.

Enemas of warm water with soap, glycerin, ox gall or oil may procure daily evacuations and are the mainstay of the medical treatment. A 25 per cent solution of peroxid of hydrogen is the most valuable agent for disintegrating a fecal accumulation which can then be evacuated with copious lavage. Rectal impactions are broken into small pieces by the gloved finger, and removed manually. Impactions in the sigmoid may be broken up by a long spoon passed through the sigmoidoscope, followed by copious irrigations.

Valvular obstructions (kinking) at the rectosigmoidal area which prevent evacuation may be overcome by passing a tube and then elevating the foot of the bed or having the patient assume the knee-chest posture.

Physiotherapy, massage (caution against rupture), faradization, bandaging the abdomen and gymnastic exercises may be advantageously combined with other therapy.

RESULTS OF NON-OPERATIVE TREATMENT

	Number of Cases	Cured Per Cent	Improved Per Cent	Died Per Cent
Löwenstein	59	12	22	66
Neugebauer	136	6.6	25.4	68

Operative.—Comparison of a series of cases of megacolon treated medically with another series in which operation was performed demonstrates the superiority of the operative method both in end-results and in mortality. The operative results are better and the mortality lower in the acquired (adult) than in the congenital (infantile) cases. Medical treatment naturally has its best field of application when the sigmoid and rectum are the seat of the disease. They are the most common site of megacolon and most accessible for treatment.

Operative treatment is indicated where medical measures fail. The type of

operation varies with the condition of the patient, location and extent of involvement, and complications present. In the presence of an acute obstruction,

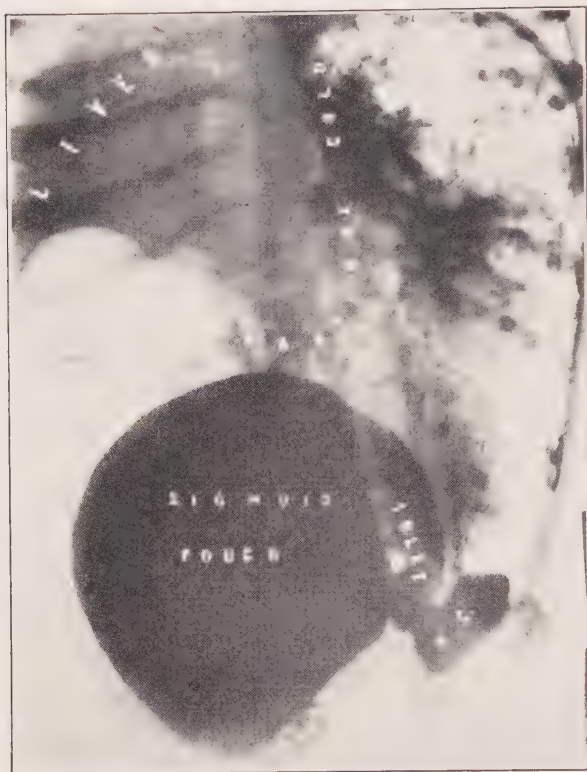


FIG. 276.—MEGACOLON.

Male aged seven years. Adhesions around the sigmoid.

as by volvulus of the sigmoid, detorsion of the loop and possibly suturing it to the abdominal wall to prevent recurrence, may prove to be a life-saving measure, although not all that is desired is accomplished.

Before operating on megacolon, it is essential to empty the bowel of its solid contents, if possible, by enemas and cathartics. In those cases in which sphincter spasm and rectal valves appear to be an obstructive etiologic factor, dilatation or incision of the sphincter and valvotomy should be done. A Pennington clip may be applied to the valve which will slough through and divide it, or an elastic ligature on a special carrier may be passed through its base, drawn taut and pinched with a lead shot until it sloughs out.

Several operative procedures have been practiced on the colon. Those that have survived are:

1. Coloplication and colopexy
2. Colostomy (colotomy)
3. Entero-anastomosis
4. Resection
5. Lumbar sympathetic ganglionectomy and ramisectomy

COLOPLICATION AND COLOPEXY.—Longitudinal plication of the dilated colon by silk or linen sutures applied along the lateral and convex borders of the gut (coloplication) has given relief in a few cases but is uncertain in results as is suture of the affected segment to the abdominal wall (colopexy).

COLOSTOMY in the area of involvement should never be done. Usually the opening does not function and the mortality is high—eleven deaths in fourteen

cases reported, the majority from peritonitis. No spur can be formed and the heavy bowel retracts from the abdominal wall. As a preliminary to resection or for urgent obstruction the colostomy should be made at some distance above the involved area, preferably in the cecum. This not only relieves the urgent symptoms but affords a means of evacuating the colon by through-and-through irrigations.

ENTERO-ANASTOMOSIS between limbs of the dilated bowel is futile. Ileosigmoidostomy is the best of the short-circuiting operations. The ileum is joined, as low down as possible, to the pelvic colon or rectum. It usually affords temporary relief only as the short-circuited loop becomes impacted and must be resected later to obtain a cure. Authorities agree that in young children, colonic exclusion should be done as the only procedure, or as the first step in colectomy. The mortality for colectomy before the fifth year is prohibitive.

RESECTION.—When the strength and condition of the patient permits, excision of the involved segment or the whole colon, if it is involved, is the operation of choice and gives the best results.

The sigmoid flexure is the most common site of dilatation, and its wide resection with end-to-end anastomosis is the best procedure when practicable. The graded Mikulicz operation, although confining the patient longer, is a safer procedure in most cases than the one-stage resection. The steps are (1) establishment of an artificial anus, (2) excision of the sigmoid flexure, (3) obliteration of the spur, and (4) closure of the anus. Barrington-Ward resected the sigmoid in five cases, with four recoveries and one death; Dowd, two cases resected in two stages, both successful.



FIG. 277.—MEGACOLON.

Same case eight years later, after division of perisigmoidal adhesions. (Roentgenograms by L. T. LeWald.)

Successful resection is usually followed by cure, although three cases have been reported in which the dilatation recurred in the same situation, possibly due to too limited excision or persistence of the obscure etiologic factor. The latter hypothesis is illustrated in the remarkable case of Maurice Richardson. The patient, a girl, had enormous dilatation of the sigmoid flexure. The sigmoid loop was resected and the descending colon joined to the rectum, forming a straight passage. Fourteen months later the symptoms of obstruction recurred and laparotomy disclosed that a new sigmoid had formed, filling the pelvis and lower abdomen, and the scar of the former anastomosis encircled its central portion. The new loop was excised, but one year later dilatation had again recurred.

The following table gives the operative method and results obtained in 143 cases collected by Dowd from 1908 to 1921:

	Cured	Improved	Unimproved	Died	Total
One-stage resection	28	3	..	11 (26 per cent)	42
Two-stage resection (intra-abdominal)	23	2	I	5 (16 per cent)	31
Two-stage resection (extra-abdominal)	11	I	..	I (8 per cent)	13
Colostomy, cecostomy, appendicostomy	3	4	..	13 (65 per cent)	20
Short-circuiting	13	..	2	7 (32 per cent)	22
Coloplication	2	..	..		2*
Colopexy	2	I	..		3*
Coloplication-colopexy .....	..	I	..		I*
"Laparotomy" .....	..	..	..	I (100 per cent)	I
"Laparotomy" with colonic massage .....	..	..	..	2 (100 per cent)	2
Incision of stricture .....	..	..	I		I
Release of volvulus	3	..	..	I (25 per cent)	4*
Colotomy .....	..	I	..		I
TOTAL	85	13	4	41 (28.7 per cent)	143

* Other patients whom the starred (*) procedures failed to cure are grouped under "Two-stage resections."

Postoperative deaths were due to: Peritonitis, sixteen; shock and collapse, thirteen; embolus, four; pneumonia, two; hemorrhage, one; other causes, five.

The influence of age on mortality in this series is shown by the following table:

Age, Years	Cured	Improved	Unimproved	Died	Total Cases
Under 6	10	3	2	12 (44 per cent)	27
6 to 10	10		2	5 (29 per cent)	17
11 to 20	16		I	4 (19 per cent)	21
21 to 40	27	3	2	5 (14 per cent)	37
41 to 60	15			7 (32 per cent)	22
Over 60	4	I		6 (55 per cent)	11

In Patel's series of 114 cases operated upon, twelve were under two years, all died; and of twenty-four from two to five years of age, fourteen died. These

figures indicate the serious hazard of major surgery in infants and children under five years of age.

LUMBAR SYMPATHETIC GANGLIONECTOMY AND RAMISECTOMY.—Recent opinion favors the view that congenital idiopathic dilatation of the colon, without demonstrable mechanical obstruction, is of neurogenic origin. The parasympathetic nerves convey motor impulses to the longitudinal muscle-fibers of the rectum, and the sympathetic convey motor impulses to the circular muscle-fibers. It is believed that irritation, probably of central origin, or an irritating lesion of the ganglia of the preganglionic or postganglionic fibers, produces a hyperactivity of the sympathetic innervation of the rectum, resulting in a disturbance of the orderly coördination of the muscle mechanism and interference with normal peristalsis. Bartle suggested that the sympathetic stimuli, conveyed to the circular muscles of the rectum, be diminished by interrupting the sympathetic ganglia below the last white ramus.

In 1927, Wade and Royle reported the application of Bartle's suggestion in the case of a boy, aged ten years, who had congenital idiopathic dilatation of the colon. After opening the retroperitoneal space, the white ramus to the first lumbar ganglion, and the medial branches from the first, second, third and fourth lumbar ganglia were severed and the trunk cut across below the fourth ganglion. Four months later the bowels acted daily without an aperient. Subsequently, Wade reported four additional cases. The results in two were very satisfactory and in two unsatisfactory.

Judd and Adson have reported two cases. The first was a boy aged eleven months with enlargement of the sigmoid ascending and distal portion of the transverse colon. Through a transperitoneal approach, the second, third and fourth left lumbar ganglia with the sympathetic chain were removed, all the rami coming to and from the ganglia being divided. Ten months later the bowels were acting spontaneously. The other case was a boy aged six years, having involvement chiefly of the sigmoid and transverse colon. A bilateral operation was performed. Two months later the patient was having two spontaneous bowel actions daily. Radiograms at this time showed a marked diminution in the size of the colon.

REFERENCES

- BARRINGTON-WARD, L. E. *Brit. J. Surg.*, Bristol, 1914, Vol. 1.
 BARTLE, H. J. *Am. J. M. Sc.*, Phila., 1926, 171: 67-81.
 CADWALLADER, R. *Arch. Pediat.*, Sept., 1916.
 DOWD, C. N. *Ann. Surg.*, Phila., Oct., 1921.
 FINNEY, J. M. T. *Surg., Gynec. & Obst.*, Chicago, June, 1908.
 FORMAD, H. F. *University Med. Mag.*, Baltimore, Vol. 4, 1892.
 GRAHAM, A. B. *Tr. Am. Proctol. Soc.*, 1913.
 HAWKINS, H. P. *Brit. M. J.*, Lond., 1907, 1: 477.
 HIRSCHSPRUNG, H. *Jahrb. f. Kinder.*, Leipz., 1887, Vol. 28.
 JUDD, E. S. *Journal-Lancet*, Minneap., Jan. 1, 1909.
 JUDD, E. S., and ADSON, A. W. *Ann. Surg.*, Vol. 88, Sept., 1928.

- LÖWENSTEIN, C. *Centralbl. f. allg. Path.*, Jena, Dec. 15, 1907.
MACHELL, H. T. *Canad. J. M. & S.*, Toronto, July, 1913.
MUMMERY, P. Lockhart. *Diseases of the Rectum and Colon*, New York, Wm. Wood & Co., 1923.
MYA, G. *Sperimentale*, Firenze, 1894, Vol. 48.
NEUGEBAUER, F. von. *Arch. f. klin. Chir.*, Berl., 1907, Vol. 82.
PATEL, M. *Arch. de gynéc.*, Oct., 1910.
PENNINGTON, J. R. *Rectum, Anus and Pelvic Colon*, Philadelphia, Blakiston, 1923.
PULS, H. *Beitr. z. klin. Chir.*, Tübing, Sept., 1910.
RANKIN, F. W. *Surgery of the Colon*, New York, D. Appleton & Co., 1926.
RICHARDSON, Maurice. *Boston M. & S. J.*, February 14, 1901.
RICHE, P. *Bull. et mém. soc. de chir.*, Paris, Dec. 12, 1911.
SMITH, R. M. *Lancet-Clinic*, Cincin., March 25, 1916.
TRONNES, Nils. *Journal-Lancet*, Minneap., Nov. 1, 1918.
WADE, R. B., and ROYLE, N. D. *Med. J. Australia*, 1927, 1: 137-141.

CHAPTER XXIV

VOLVULUS OF THE SIGMOID COLON

Incidence.—Volvulus is a type of intestinal obstruction due to a torsion or twisting of the bowel upon itself or upon its mesentery. It is responsible for about 4 per cent of cases of intestinal obstruction. In a review of 318 cases of occlusion of the intestine, Ohman found volvulus of the cecum in fifty-three cases and of the sigmoid in the same number. In the colon, the most frequent sites of occurrence are the sigmoid and cecum, the incidence being about three to one. The majority of cases occur in adults (twentieth to fortieth year); it is rare in children and old people, and still rarer in infants.

Pathogenesis.—The basic causes of sigmoid volvulus are anatomical and pathological. Anatomically a long sigmoid and mesentery with a short base of attachment favors axial rotation; and the greater the disproportion the more likely is its occurrence. This observation, made by Leichtenstern in 1878 is still valid. Chronic inflammatory changes in the mesosigmoid result in narrowing of its base of attachment and produce a mechanism favoring easy rotation; or adhesions and cicatrices of its peritoneal layers may contract the root of the mesentery into a pedicle around which the free portion may rotate. An abnormally long sigmoid is usually congenital, but the mesentery may be still further elongated by overloading the loop with feces, as occurs in chronic constipation, and by the traction on it in enteroptosis, especially when the abdominal wall is weak and relaxed. Rankin reports a case in which the descending colon and sigmoid had a common mesentery, resulting in a chronic volvulus. Narrowing of the root of mesenteric attachment is usually pathologic, the result of an inflammatory process, diseased lymphatic glands, a tumor (lipoma or sarcoma) or cyst in the mesosigmoid.

The *exciting causes* of volvulus are not clear. When the above anatomical conditions are present it is rational that disturbed function may easily precipitate an attack, as an overloaded sigmoid in chronic constipation, or the violent peristalsis excited by drastic cathartics. Volvulus has also followed direct trauma.

The pathological changes in the involved loop depend upon two factors: The degree of occlusion of the bowel lumen and the interference with its blood supply. If the twist is more than one turn (180 degrees) both factors are usually operative. The twist is usually in a clockwise direction. Following an acute occlusion of the sigmoid, if there is only slight interference with the blood supply, the affected loop undergoes rapid distention with gas as a result of fermentation of its contents. The hugely distended loop rises in the abdominal cavity, displacing other organs, but seldom ruptures. The rapid distention in

acute volvulus is the chief factor in preventing detorsion. Interference with the blood supply produces the changes characteristic of strangulation, ending in gangrene. Sepsis usually results fatally before perforation occurs.

Symptoms.—The symptoms of volvulus of the sigmoid vary with the degree of obstruction of its lumen and interference with the circulation. *Chronic volvulus* of the sigmoid usually occurs in adults and refers to a partial torsion, detorsion occurring before complete occlusion takes place. Habitual constipation is usual in these cases and when a partial twisting occurs, acute, colicky pain is experienced in the lower abdomen, a dragging feeling in the back due to the mesenteric tug, nausea and rarely vomiting. There is usually slight distention in the left lower quadrant of the abdomen. When detorsion occurs flatus is usually expelled and the symptoms abate. Attacks occur at varying intervals over a period of months or years, and there is always the possibility of a chronic volvulus becoming acute. While it may be impossible to diagnose a chronic volvulus with certainty, the symptoms of an attack are quite characteristic. Between attacks an x-ray examination should be made. This will usually show a redundant sigmoid coiled in bizarre fashion.

Acute volvulus, completely occluding the bowel lumen and interfering with its blood supply, may be primary or develop on the chronic type. The onset is sudden, without previous warning. The pain is persistent, colicky in character, and marked by exacerbations. The pain may be tolerable so that treatment is delayed. Nausea and vomiting are usually prominent symptoms but may be delayed or absent. After the initial shock has passed the pulse may be only slightly accelerated and the temperature but slightly changed. Enemas afford no relief to the constipation.

Diagnosis.—The *signs* of intestinal obstruction appear early in acute volvulus of the sigmoid. Abdominal examination within a few hours of the onset of symptoms shows distention localized in the left lower quadrant and the affected portion of gut can be felt as a tender swelling through the abdominal wall. In the later stages uniform distention and tenderness of the abdomen, due to peritonitis, obscure the early signs, but visible peristalsis may be observed. A positive and correct diagnosis of volvulus is not usually made before operation. However, it is evident that the condition is one of partial or complete intestinal obstruction demanding immediate surgical intervention. To be considered in the differential diagnosis are other acute abdominal lesions, as strangulation of the bowel by a band, as we have observed in cases of acute appendicitis, where the abscess was drained and the appendix left; mesenteric thrombosis, acute pancreatitis, acute perforation of the stomach or duodenum, and strangulated hernia.

Prognosis.—The prognosis in acute volvulus of the sigmoid is unfavorable. Detorsion, spontaneous or by the aid of enemas, is exceptional. The operative prognosis depends largely upon the elapsed time from the onset of symptoms to operation and the damage already sustained by the affected bowel. In chronic volvulus there is always the liability of an acute attack supervening.

Treatment.—In certain cases of chronic recurrent volvulus of the sigmoid, careful regulation of the bowels by retention oil enemas, a supporting abdominal belt and improvement of nutrition may prove successful.

Example: Mr. W., aged fifty-three, enteroptotic and chronically constipated, had attacks of acute pain and distention in the lower abdomen accompanied by anorexia and nausea. These occurred at intervals two to six weeks over a period of years. X-rays demonstrated a redundant coiled sigmoid (Fig. 278). The above treatment was carried out and the attacks did not recur.

Operative treatment is indicated in the majority of cases of chronic volvulus. The operative measures may be restricted to the mesentery. If bands are present, causing its plication, they may be divided, and then the elongated mesentery is shortened by transverse plication. After obtaining a good exposure, a row of Lembert sutures is placed in the *outer* leaf of the mesentery only, great care being taken to avoid the blood-vessels. A second or even a third row of sutures are superimposed until sufficient shortening is obtained. Any kinks in the bowel resulting from the plication are relieved by a Lembert suture inserted obliquely opposite the kink (Fig. 279). Another effective way of preventing recurrence is sigmoidopexy or suture of the sigmoid to the posterior layer of the rectus fascia exposed by an incision of its peritoneum. Direct suture to the peritoneum is followed frequently by formation of a peritoneal band and sagging of the gut. The best and only certain method of preventing recurrence is resection of the sigmoid and end-to-end anastomosis, but the risk involved is naturally greater than when the other methods are employed.



FIG. 278.—VOLVULUS OF SIGMOID.
Recurrent attacks in male aged fifty-three years.

Surgical Treatment of Acute Volvulus.—Immediate operation is the only treatment for acute volvulus. After opening the abdomen through a large incision,



FIG. 279.—TRANSVERSE PLICATION TO SHORTEN THE ELONGATED MESOSIGMOID BY LEMBERT SUTURES PASSED THROUGH ITS OUTER PERITONEAL LEAF ONLY.

the operative procedures resolve themselves into detorsion of the affected sigmoid, usually in a counter-clockwise direction; fixation to prevent recurrence, or resection. Huge distention of the loop may prevent manipulation. In this event, the loop should be packed off and emptied by a trocar and cannula or a large catheter. The distended loop is temporarily paralyzed, so that it is usually wise to establish an artificial anus to drain its septic contents. If mesenteric thrombosis has occurred or the bowel shows pathologic changes beyond recovery (necrosis or gangrene) it must be delivered

upon the abdomen, the diseased portion resected, and a tube tied in each end remaining. The ends of the bowel are sutured in the abdominal wound. This is a formidable procedure and has a high mortality.

REFERENCES

- MUMMERY, P. L. *Diseases of the Rectum and Colon*, New York, Wm. Wood & Co., 1923.
 RANKIN, F. W. *Surgery of the Colon*, New York, D. Appleton & Co., 1926.

CHAPTER XXV

INTESTINAL OBSTRUCTION OF RECTAL AND SIGMOIDAL ORIGIN

Intestinal obstruction is a mechanical or paralytic blockage of the passage of the intestinal contents. Strangulation connotes obstruction plus a cutting off of the blood supply of the involved gut and its mesentery.

The obstruction may be acute or chronic. Although acute obstruction comprises only about 30 per cent of all cases of ileus, it is by far the more important class because of the urgency of the condition. The site of obstruction is in the large intestine in approximately 10 per cent of cases.

Etiology.—Acute intestinal obstruction may be due to a sudden loss of propulsive peristalsis (dynamic or paralytic ileus), in which the bowel lumen is not occluded. Causal conditions are: (*a*) Inflammatory (trauma, acute peritonitis and postoperative); (*b*) toxic, as in typhoid fever sepsis; (*c*) reflex (renal or biliary colic); and (*d*) infarction of mesenteric vessels.

Mechanical obstruction may be due to simple occlusion or to strangulation. The obstructing agent may be within the bowel, as enteroliths, scybala, large gall-stones, masses of intestinal worms, or a foreign body; pathology in the bowel wall, as tumors or inflammatory conditions; or external compression of the bowel by tumors, cysts or displaced organs. Other causes are intussusception, especially in children; volvulus, seen more frequently in adults; and strangulation, observed in internal and external hernia, by Meckel's diverticulum, congenital bands, or adhesions and bands following laparotomy.

Obviously an extended discussion of intestinal obstruction is precluded in this work. Nevertheless, the sigmoid flexure of the colon and the rectum are so frequently the site of mechanical obstruction that this phase of the subject merits consideration.

Paralytic ileus may be dismissed from consideration as it chiefly affects other intestinal segments.

Anatomical and physiological factors in the sigmoid and rectum predispose these segments to certain types of obstruction, while other types predominate elsewhere in the intestinal tract. The *anatomical* factors are the normal narrowing, angulation and fixation at the rectosigmoidal junction and at the junction of the descending colon and sigmoid; *physiological*, the formed content of the sigmoid and rectum; and *pathological* in neoplasms, the form of the growth, which in one-fourth of carcinoma cases tends to encircle and constrict the bowel lumen, in these segments.

The most frequent causes of intestinal obstruction in the distal colon and

rectum are volvulus, intussusception, Hirschsprung's disease, diverticulitis, tuberculosis, stricture, neoplasms, fecaliths, enteroliths and foreign bodies.

Intestinal obstruction as a symptom or terminal state in these conditions is emphasized in the respective chapters on the subjects.

Volvulus usually occurs in adults. The segment of bowel most frequently involved is the sigmoid colon; next the ileocecal angle. Meteorism is localized and vomiting is an early symptom. The pain at first is local, but may also be referred to the back, due to mesenteric tension. Because of strangulation, toxic symptoms are early and marked. A detailed history will show that, in many cases, recurrent attacks of volvulus with spontaneous detorsion preceded the acute attack and complete obstruction.

Intussusception occurs predominantly in young children, 70 per cent of all cases, during the first year of life. It is a variety of obturation obstruction. The ileum, invaginated into the colon, sometimes advances into the rectum where it may be felt, resembling a soft cervix uteri. The symptoms of obstruction are prominent. On the other hand, invagination of the sigmoid into the rectum may occur in either adults or children, is usually marked by recurrent attacks of partial obstruction which rarely are acute and complete.

Hirschsprung's disease or megacolon is a congenital condition characterized by inveterate constipation and fecal impaction which, unless it can be relieved, terminates in acute obstruction in the distal colon.

Enteroliths, fecaliths, large gall-stones, or foreign bodies lodged in the sigmoid or rectum may cause partial or complete obstruction.

Inflammatory processes resulting in obstruction in the sigmoid or rectum are diverticulitis, tuberculosis and stricture. The sigmoid colon is the most common site of diverticulitis. Due to chronic infiltration and thickening of its walls and secondary adhesions to other organs the obstruction is usually of slow development and only partial. Rarely acute obstruction supervenes upon a chronic diverticulitis as occurred in one of our cases.

Hyperplastic tuberculosis invades the cecum rather than the sigmoid, but may rarely lead to occlusion in the latter situation.

Organic or fibrous stricture is usually situated in the rectum. Symptoms of progressive obstruction are characteristic. An acute inflammatory swelling at the site of constriction may result in complete occlusion of the bowel lumen.

Neoplasms.—Simple tumors seldom encroach on the bowel lumen to a degree sufficient to cause complete obstruction. The same may be said, as a rule, of sarcoma, which occurs very rarely in the rectum, approximately one to two hundred carcinomata.

Carcinoma in the large bowel is situated most frequently in the rectum; second, in the sigmoid, and third, in the cecum, and is the chief cause of obstruction in the colon. Owing to the softer character of the growth and large lumen of the cecum, obstruction occurs here less frequently than in the distal segments of the colon. On account of the large diameter of the rectal ampulla, obstruction by a cancer in this location is a late manifestation.

When the anatomically much narrower rectosigmoidal angle or junction of the descending colon with the sigmoid is the site of the growth, obstructive symptoms are marked and early.

Symptoms.—The onset of acute intestinal obstruction is usually sudden with severe abdominal pain, vomiting and collapse. On the other hand, in the case of inflammatory stenosis or malignant tumors, the onset is usually more gradual and progressive. Constipation is the cardinal symptom.

Acute obstruction is the initial evidence of a carcinoma in a small proportion of cases. In general, the higher the obstruction the more severe and rapidly progressive are the symptoms. Hence, when the site of stenosis is the sigmoid, or rectum, the early symptoms may be comparatively mild.

As a rule the pain is continuous with periodic exacerbations. The initial vomiting is reflex, later regurgitant. The vomitus at first consists of the gastric contents, then is bile stained, and finally fecaloid. After the bowel distal to the obstruction is emptied by enemas, neither gas nor feces are expelled by rectum. Proximal to the obstruction gas accumulates, causing meteorism and increased intra-abdominal pressure. The quickened pulse tends to become thready. The temperature, which usually rises only slightly, becomes subnormal in collapse. The development of meteorism hampers breathing, the respirations becoming rapid and shallow.

If the obstruction is unrelieved, the face becomes pale, the expression anxious, eyes sunken, the skin clammy and the extremities cold. Thirst is marked and there is oliguria. Yet the mind may remain clear and the patient hopeful.

Diagnosis.—The endeavor is made to determine the nature and site of the obstruction. A careful study of the history is essential, particularly former attacks of abdominal pain, old hernia and previous abdominal operations. In low obstruction the abdomen becomes markedly distended. At the onset localized meteorism is a prominent feature of volvulus. Sometimes visible peristalsis may be seen early, or the recurrent pattern of a spasmodic loop of bowel. Later, when the paralysis of exhaustion occurs, this sign is lost and there is a misleading relief of the paroxysmal pain. Distention and a complicating peritonitis (protective spasm) may baffle satisfactory palpation. A mass felt in the left lower abdominal quadrant may be a carcinoma, chronic diverticulitis or a volvulus.

Rectal palpation should always be done. A stricture or obstructing growth may be felt, and sometimes an intussusception in children.

Proctosigmoidoscopy is of the greatest value to discover obstructive lesions beyond reach of the finger in the upper rectum and pelvic colon.

Light percussion differentiates tender from tympanitic areas. By auscultation with the stethoscope we may recognize intestinal movements, and their focus of greatest intensity suggests the point of obstruction.

A typical ileus syndrome may be produced by the torsion of a tumor pedicle. In a recent case, having symptoms of acute obstruction of the sigmoid, the

left ovary and tube were found at operation to be incarcerated in the left inguinal canal.

Chronic obstruction must be sharply differentiated from the acute form. As chronic obstruction is usually slowly progressive, there is generally time to determine the approximate site and character of the lesion, provided it is in the rectum or sigmoid colon, the two segments of the intestinal tract most accessible to examination and the most common sites of obstruction of the



FIG. 280.—RADIOGRAM.

Acute intestinal obstruction due to inflammatory stricture 2 inches in length in pelvic colon, proved by laparotomy. The barium clysma could not be forced beyond the point of obstruction. Female, aged sixty-five years.

colon. A history of recurring attacks of severe lower abdominal pain with nausea, suddenly relieved, suggests a partial volvulus, spontaneously untwisted. Progressive constipation, colicky pains, and blood in the stools point to chronic obstruction of the bowel by malignant disease. This frequently ends in acute obstruction due to a sudden inflammatory swelling as a result of irritation by the blocked intestinal contents.

Roentgen Rays.—In acute obstruction, the time element precludes their use and usually roentgenologic methods are not applicable. However, when

the x-ray is available, a picture of the abdomen, without the injection of an opaque substance, outlines areas of meteorism, thus suggesting the point of obstruction, and may define an intussusception.

In chronic intestinal obstruction the x-rays are an invaluable aid in diagnosis. They reveal diverticulitis, and deforming and obstructive lesions of the sigmoid and other colonic segments. They also demonstrate foreign bodies in the bowel lumen as well as surgical instruments, accidentally left within the abdomen at a previous operation which may cause obstruction. For obstructive lesions of the rectum, x-ray examination is frequently misleading and is less reliable than digital palpation and direct inspection through the proctoscope. For these reasons proctosigmoidoscopy should precede the x-ray examination.

Acute mechanical obstruction is to be differentiated from diaphragmatic pleurisy, central pneumonia, tabetic crises, uremia, and the reflex intestinal paralysis of hepatic and renal colic. An acute intra-abdominal inflammatory process may have an associated intestinal paresis, but the protective spasm of the abdominal muscles due to peritoneal irritation is absent in beginning obstruction. A malignant growth is the cause in the vast majority of cases of obstruction.

Prognosis.—Complete obstruction with strangulation if unrelieved is fatal in from three to five days, but patients with simple occlusion may live one or two weeks. As Van Bauran remarks, "The longer the patient with bowel obstruction lives before operation, the sooner he dies after operation." Delay in diagnosis and too late surgical intervention raise the mortality.

Treatment.—For obstruction of the sigmoid due to malignant or inflammatory disease colostomy under local anesthesia proximal to the obstruction is indicated. After the acute condition has subsided, an analysis of x-ray and other data determines the further treatment. The same treatment applies to an obstructing carcinoma of the rectum. For organic stricture in this situation, incision of the structure and insertion of a large rubber tube beyond it, is usually feasible and satisfactory.

CHAPTER XXVI

NON-MALIGNANT TUMORS OF THE RECTUM AND COLON

Examination of the rectum and sigmoid colon by modern methods of direct inspection through endoscopes, and of the colon by the x-ray has stimulated study that is increasingly enhancing our knowledge of the pathology of these organs. This is notably true of ulcerations and new growths.

Ewing concurs with Prudden in defining a tumor as an autonomous new growth of tissue.

The simplest classification of tumors is on the basis of their histologic structure, as follows:

Epithelial type (pavement or glandular): Papilloma, adenoma, epithelioma (epidermoid carcinoma), carcinoma.

Connective-tissue type: Fibroma, chondroma, lymphoma, lipoma, myxoma, angioma and sarcoma.

Muscle-tissue type: Leiomyoma (smooth muscle-cell) and fibromyoma.

In addition to these well-defined types, teratoma or cystoma, vegetations and excrescences are encountered.

Benign anorectal tumors are usually encapsulated or sharply circumscribed, have a systematic arrangement of fully developed cells, do not tend to invade adjacent structures, and seldom recur when extirpated. In contrast, the cellular elements in malignant neoplasms are imperfectly developed, irregularly arranged and develop outside of their normal site.

Polyp refers to the form and not the histologic structure of a growth. Thus a papilloma, adenoma, fibroma, myoma or lipoma of the rectum may have the morphology of a polyp, *i.e.*, a neoplasm attached to the rectal wall by a pedicle narrower than the tumor itself.

Dewis, in 1906, collected from the literature 219 cases of benign tumors of the intestinal tract, including one of his own, all of which had been carefully studied under the microscope. Leichtenstern has compiled 128 intestinal polypi. The variety and distribution of this total of 347 cases are given in the table on page 447.

Excluding the 101 rectal cases from Dewis' group of 219, intussusception occurred in two of five fibromata, in nine of forty myomata, in sixteen of forty-four lipomata, and in ten of 127 adenomata.

ADENOMATA

Although approximately two-thirds of all intestinal adenomata appear in the rectum, less than one-fourth of all the other forms combined are found

	Angiomata Including Papilloma- tous Tumors	Fibromata	Myomata	Lipomata	Adenomata	Total
Duodenum	0	0	3	6	6	15
Jejunum	0	0	2	4	8	14
Ileum	0	2	11	7	37	57
Vermiform appendix	0	0	1	0	2	3
Cecum	0	0	3	2	6	11
Colon (including sigmoid)	0	1	5	10	40	56
Rectum	2	2	10	6	156	176
Small intestine	1	..	1	2	..	4
Intestine undefined .....	..	..	4	7	..	11
TOTAL	3	5	40	44	255	347

in this situation. An adenoma is a benign tumor of glandular epithelium in normal arrangement, supported by a connective-tissue stroma. Adenomata are the most common variety of benign intestinal growths and may occur in any segment of the intestinal tract, but chiefly in the rectum; then, in order of

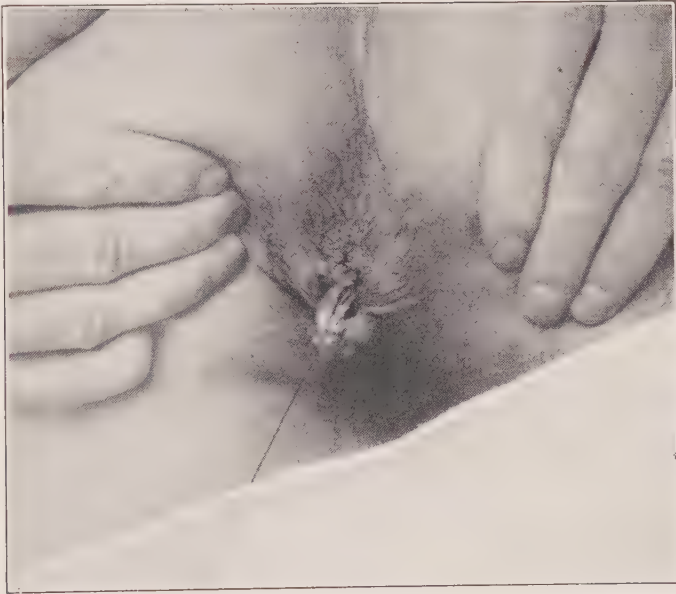


FIG. 281.—POLYP PROTRUDED FROM RECTUM.

Boy, aged nine years. Pedicle 3 centimeters long attached to anterior rectal wall 4 centimeters above anus.

frequency, the ileum, colon, ileocecal valve and duodenum. They appear as small or large, single or multiple, polypoid or sessile growths projecting from the mucosa into the lumen of the bowel. In form they are sessile or pedunculated, and occur either as the solitary polyp, multiple adenomata or villous tumor. They have a common origin from the mucous membrane and are of the same

histologic structure, namely glandular with connective tissue intermingled, the relative amount of glandular tissue usually being greater in adenomata removed from adults. In most instances they probably originate from a localized inflammatory hyperplasia of the normal glandular elements, to which later me-

chanical and other irritative factors contribute.

Clinically, adenomata occur most frequently in children from three to ten years of age, although they are not unusual in adults. In children there is usually a single growth, having the size and appearance of a red cherry, but three or four scattered tumors may be present. In the author's thirty-five cases in children and young adults, no single adenoma has been larger than an English walnut. On the other hand, in adults the growth may reach an enormous size, completely filling the bowel lumen.

When the single variety assumes the polypoid form the pedicle may be from 1 to 5 inches in length. The size of the pedicle varies with



FIG. 282.—LYMPHADENOMA (MAGNIFIED 200 DIAMETERS).

HH, hypertrophied, newly formed glands; CC, connective tissue containing numerous lymphocytes.

the duration and size of the tumor. Through its weight and the increased peristalsis excited in the bowel to rid itself of the growth, the pedicle may be attenuated even to the size of a darning needle. In this event the pedicle may break and the tumor be cast off, spontaneous cure resulting. The pedicle or stalk grows from the submucosa. It is made up of a mucous membrane covering, enclosing connective tissue and blood-vessels. The tubules of the mucosa are decreased and the epithelium, which is somewhat atrophied, is continuous with the columnar epithelium covering the tumor and that lining the intestinal canal. The core of fibrous tissue passes longitudinally through the pedicle to the tumor where it branches out in arborescent fashion, forming the lobes which compose

the growth. The consistency and vascularity of the tumor is in proportion to the amount of fibrous tissue it contains.

Inflammatory processes and pressure alter the diameter and shape of the tubules. The surface epithelium is frequently abraded due to friction by the fecal masses and the excursions of the growths against the rectal wall.

Adenomata may undergo hyaline, myxomatous or cystic degeneration, but ordinarily do not develop metastasis.

Symptoms.— Usually the symptoms of a single or few growths in children are constipation and straining at stool, discharge of a small amount of bright red blood or dark clot and mucus, and occasionally extrusion through the



FIG. 284.—MULTIPLE ADENOMATA OF RECTAL AMPULLA AS SEEN THROUGH PROCTOSCOPE.

anus of the polypoid tumor which is reduced spontaneously or is replaced by hand. Partial or complete prolapse of the rectum may be a secondary result of the tenesmus and drag of the tumor through its pedicle.

In adults single adenomata are usually sessile or have only short pedicles. Bleeding and a sense of weight in the pelvis are the characteristic symptoms.

Diagnosis.—As the most common site of the growths is the lower 3 inches of the rectum, the examining finger usually feels the soft elastic or occasionally firm tumor which, if pedunculated, can be dragged through the anus. Digital

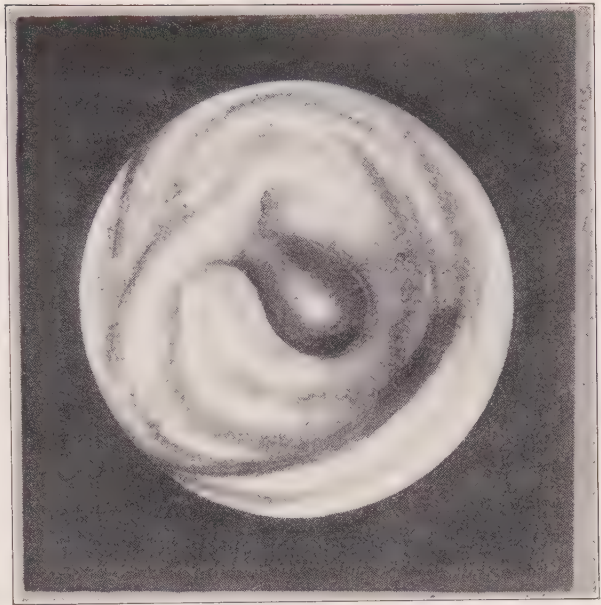


FIG. 283.—SOLITARY ADENOMATOUS POLYP OF RECTUM AT LEVED OF 5 INCHES.

Proctoscopic. Female, aged ten years.

palpation, however, may be negative when the tumor is situated at a higher level, or has a long pedicle which allows it to recede before the examining finger. In any event, a proctoscopy should always be done. This inspection reveals infallibly the site, number, size and form of the growths, and is essential to assure removal of all of them.

Treatment.—The simplest treatment for the small pedunculated growths is to snare them off with a rectal snare, or if they can be grasped and pulled

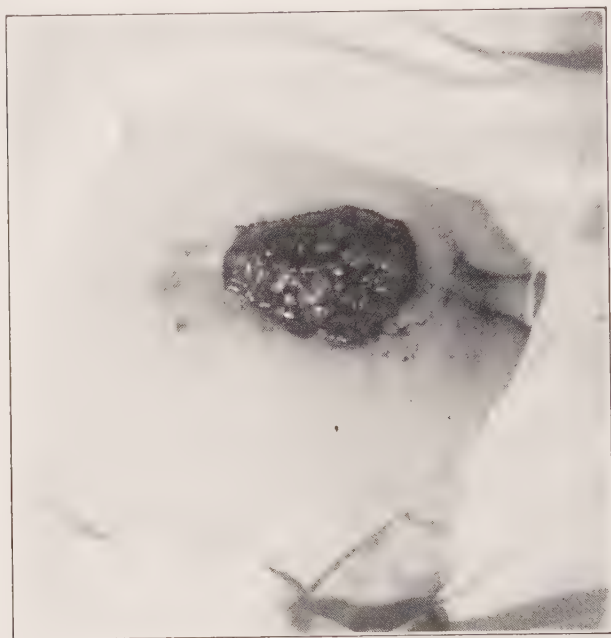


FIG. 285.—ENORMOUS PAPILLOMA OF RECTUM EXTRUDED THROUGH ANUS.

Broad flat pedicle ligated in sections and tumor excised without anesthesia. Male, aged sixty-five.

down, the pedicle, if small, may be ligated close to the bowel wall and the tumor snipped off. Larger pedicles should be transfixed and doubly ligated to prevent the ligature from slipping off the stump, resulting in secondary hemorrhage. In two cases of huge papillary adenoma in the author's series, the growth was attached to the bowel wall by a short broad pedicle.

Case.—J. McA., male, aged sixty-five years. During two years a large mass protruded at stool which had to be reduced by hand. While extruded, the tumor bled freely and was painful (Fig. 285). Blood-clots passed independent of stool; anemia and weakness were progressive. Weight loss was 15 pounds. Red blood-cells numbered 2,910,000; hemoglobin, 34 per cent, color index, 0.6; blood Wassermann, negative. A pear-shaped tumor 3 inches broad and $2\frac{1}{2}$ inches from base to apex filled the rectal ampulla and was attached to the anterior rectal wall 3 inches up by a very short pedicle 2 inches in breadth.

Without anesthesia, the tumor was delivered through the anus. Suture ligatures of heavy chromic catgut were passed and tied. As each ligature was tied

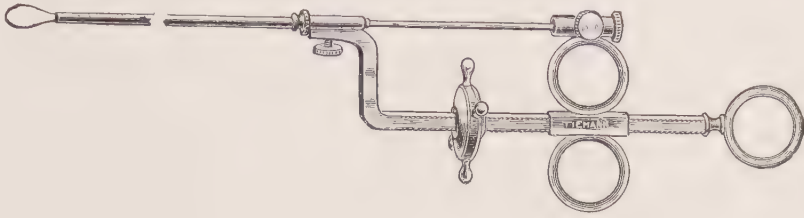


FIG. 286.—YEOMANS' COLD WIRE SNARE.

the pedicle distal to it was cut and the process repeated until the entire pedicle was severed. The patient quickly regained his health and strength. Now, two and one-half years after operation, he is of normal weight, hemoglobin



FIG. 287.—YEOMANS' POLYPUS HOLDING FORCEPS.

77 per cent and only a fine pale scar marks the site of the growth. This method of removal is very satisfactory in preventing hemorrhage during and after operation.

Although a solitary adenoma, especially if sessile, may exist for years with-

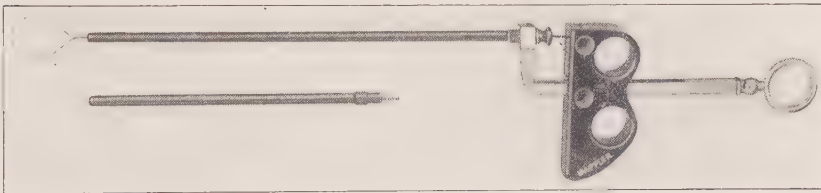


FIG. 288.—YEOMANS' HIGH FREQUENCY ELECTRIC SNARE FOR USE THROUGH THE PROCTOSCOPE.

out causing serious symptoms or becoming malignant, the many authentic cases of malignant degeneration reported justify the conclusion that every growth of this type should be considered a precancerous lesion and promptly eradicated. It may be confidently stated that many cancers of the rectum and sigmoid develop from adenomata which could have been detected and removed while still innocent if proctosigmoidoscopy were employed more regularly in routine examination.

In general, the more sessile a growth, the greater is its liability to malignant degeneration. Seven instances of such transformation have occurred in the writer's experience. Saint found carcinomatous change in three cases of single adenoma, all small and situated in the sigmoid.

In the removal of a sessile adenoma, wide excision of the base is indicated and cauterization or electric coagulation of the site of removal.

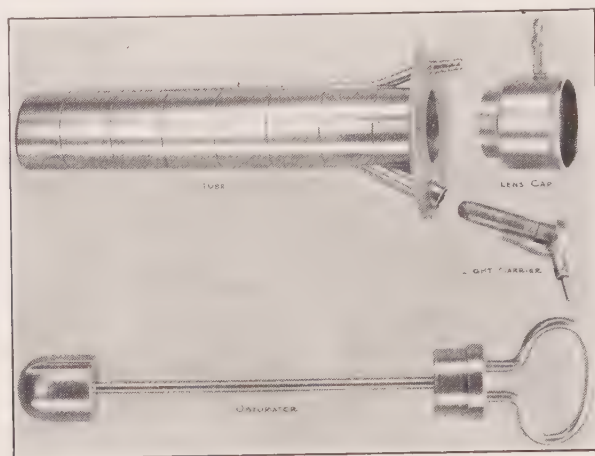


FIG. 289.—YEOMANS' OPERATING PROCTOSCOPE.

For snaring, fulguration, or electric coagulation of tumors of the rectum; and for insertion of radon implants. (Wappler, New York.)

Solitary adenomatous polyps, beyond reach of the finger but accessible through the operating proctoscope, present a difficult problem. If pedunculated they may be snared off through the proctoscope by the author's strong, prac-

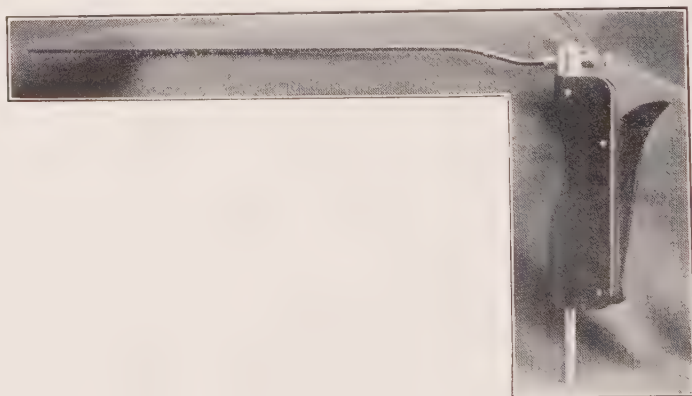


FIG. 290.—HANDLE AND ELECTRODE WITH OFFSET ALLOWING UNOBSTRUCTED VISION WHILE USING SURGICAL ENDOTHERMY THROUGH THE PROCTOSCOPE.

tical snare designed for this purpose (Fig. 286). When the growth approaches the sessile form but is removable, the possibility that it is already malignant must be borne in mind. Under these circumstances, electric coagulation (surgical endothermy) at the base, or when the tumor is snared off, implantation of

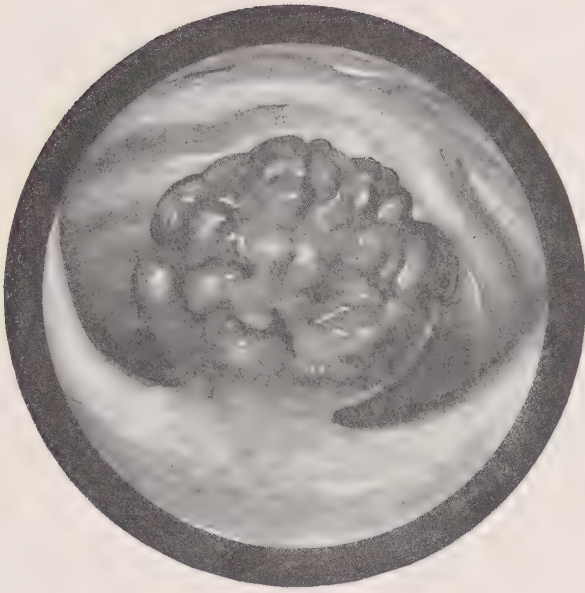


FIG. 291.—ADENOCARCINOMA ON RECTAL VALVE AS VIEWED THROUGH THE PROCTOSCOPE
AT A HEIGHT OF 5 INCHES.
Male, aged sixty-seven years.

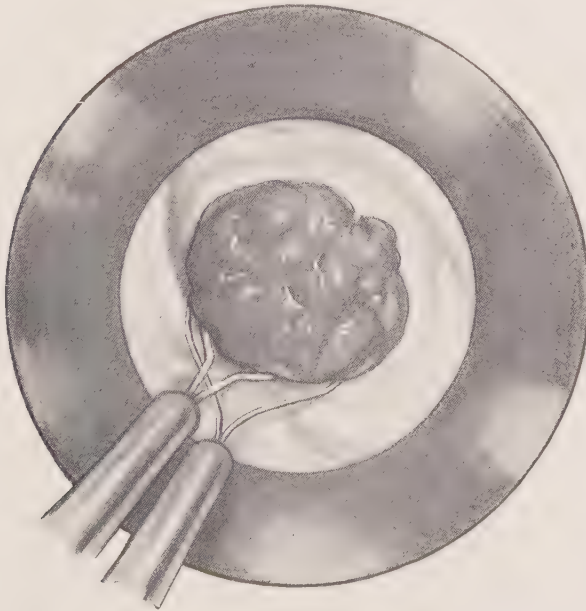


FIG. 292.—POLYP FORCEPS (LEFT) HOLDING TUMOR IN SNARE (RIGHT). PROCTOSCOPIC.

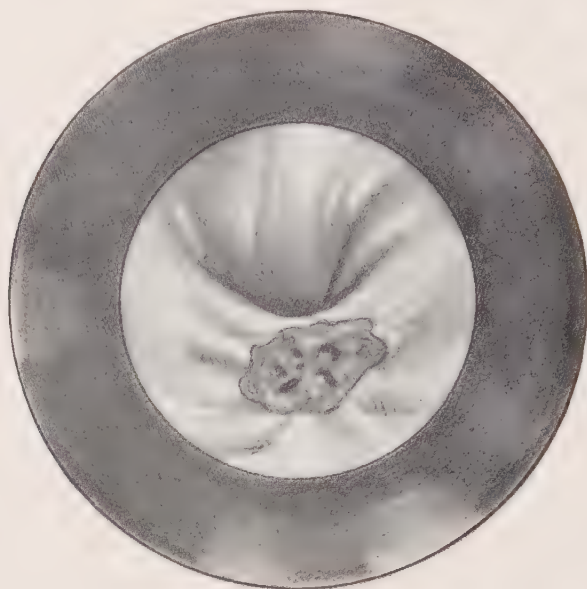


FIG. 293.—APPEARANCE IMMEDIATELY AFTER REMOVAL OF TUMOR.

seeds of radon (radium emanation) in and around the site of removal, are efficient safeguards against dissemination in case the tumor has already undergone malignant degeneration. Otherwise approach to these high-lying growths, inaccessible from below, must be made through the abdomen which involves the usual risk of peritoneal infection when the pelvic colon is laid open.

Case.—C. M., male, aged sixty-seven. During the six months prior to consultation, this patient passed fresh blood with his stools and two large hemorrhages had occurred. He felt weak and dizzy and had lost 8 pounds in weight. Digital examination was negative but proctoscopy showed, at a level of 5 inches, a growth 3 centimeters in diameter, attached to the upper surface of the highest valve of Houston. Its base, 2 centimeters broad, did not convey the impression of being indurated when a probe was applied to it. In May, 1926, without anesthetic, the growth was snared off very slowly through the proctoscope, a small portion of mucosa being grasped in the loop (Fig. 292). Hemorrhage was slight and the wound was carbolized.

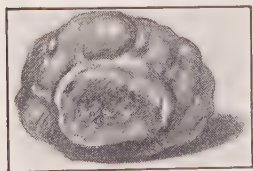


FIG. 294.—THE EXCISED GROWTH, NATURAL SIZE.

No recurrence two years after operation.

Histologic study of the growth demonstrated adenocarcinoma (Fig. 295). Five days later, six glass seeds, each containing 0.3 millicuries of radium emanation, were implanted in and around the site of removal. Two years have now elapsed, the patient is clinically well. Only a smooth scar is present and no signs of recurrence.

Two noteworthy points when using the snare are that usually no anesthetic is necessary, as the rectal mucosa is not sensitive; and the wire should be heavy

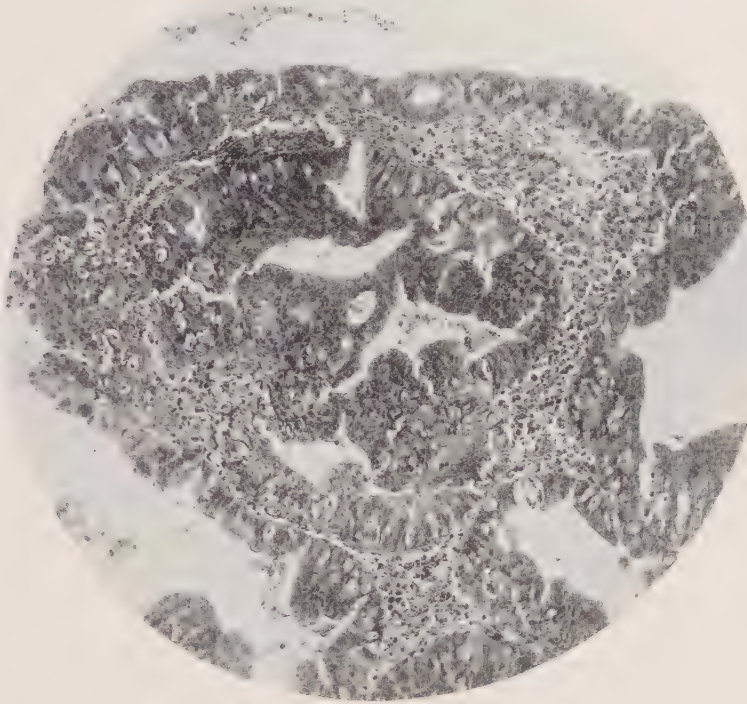


FIG. 295.—PHOTOMICROGRAPH OF TUMOR WHICH WAS PROBABLY CARCINOMATOUS DEGENERATION OF AN ADENOMA AND OF RELATIVELY MILD MALIGNANCY.

and plenty of time (fifteen to twenty minutes) occupied in very slowly severing a thick pedicle. Otherwise smart bleeding may ensue.

PAPILLOMA

Villous tumor or papilloma is an exceedingly rare variety of benign intestinal growth, only about fifty cases having been reported. It usually occurs in adult or advanced life, the majority of cases above the fortieth year. In Quénu and Hartmann's series of sixteen cases, eight in men and eight in women, the youngest patient was twenty-eight years of age.

The etiology is probably the same as that of adenomata. The growth is usually classified as papilloma, although some investigators assign it a mid-position between true papilloma and papillary adenoma. They arise from the mucosa of the rectum or pelvic colon and are attached by a broad base of mucous membrane rather than by a pedicle, but the mucosa may be dragged out an inch or

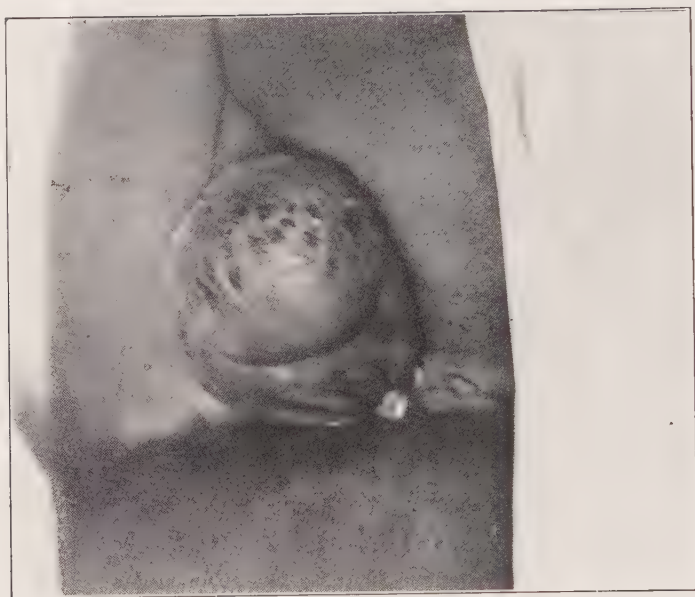


FIG. 296.—LARGE PAPILLOMA OF ANUS.
Female, aged fifty-four. Tumor present thirty years. Removed under local anesthesia.



FIG. 297.—SEBACEOUS CYST AT ANAL VERGE.
Present two years. Male, aged twenty.

more. Usually the growth is plaque-like rather than spherical. Ordinarily, villous papilloma does not exceed the size of an egg but may be fist size (Cripps) or fetal head (Allingham). Grossly the tumor is red in color, soft and velvety to the touch, and bleeds freely on contact. It is composed of large numbers of villi or papillæ, free at their surface but conjoined at their base, thus forming a lobulated tumor. A delicate highly vascular framework of adenoid tissue covered by a single or multiple layers of cuboidal epithelium constitutes the structure of the growth.

Symptoms.—Although the patient may be actually constipated at first, frequent passages of thick viscid or watery mucus, frequently blood streaked, is characteristic. Tenesmus is noted and occasionally severe hemorrhage. The constitutional effects of the discharge and bleeding manifest themselves in debility, pallor and loss of weight. On digital examination the tumor is soft and velvety, lacking the solidar-

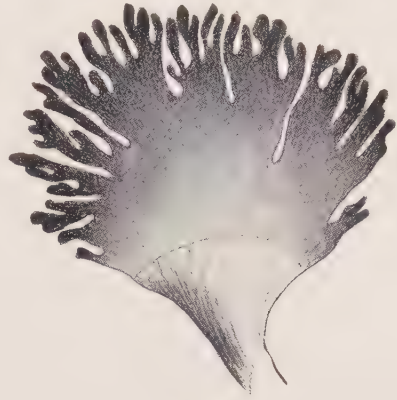


FIG. 298.—SCHEMATIC ILLUSTRATION OF RECTAL PAPILLOMA.



FIG. 299.—PAPILLOMA OF RECTUM (MAGNIFIED 200 DIAMETERS).

PP, papillæ covered by columnar and partly cuboidal epithelia; *TT*, connective tissue infiltrated with lymphocytes and polymorphonuclear leukocytes; *B*, blood-vessel.

ity characteristic of adenomata. The finger can be insinuated between the lobes and there is no induration in or about the site of implantation of the tumor in the mucosa.



FIG. 300. DEFECT IN RECTUM DUE TO VERY LARGE PAPILLOMA.



FIG. 301.—PHOTOGRAPH OF THE EXCISED GROWTH.
Female, aged seventy-seven. Same case as Fig. 300.

Treatment.—Because of their pronounced tendency to recurrence and malignant degeneration, radical surgical removal, including thorough extirpation of the base, should always be practiced. For growths not accessible below, approach must be gained through the abdomen. The prognosis for villous papilloma and adenomata is good provided they are radically extirpated before the onset of malignant change. An illustration is the case of Mrs. K., aged seventy-seven. For a period of one year, bowel movements averaged eight by day and three at night, containing much blood-tinged mucus, and were accompanied by tenesmus and protrusion. Loss in weight, anemia and weakness were progressive. A large hemorrhage had occurred. The attachment of the tumor began just within the rectum and extended spirally upward a distance of 5 inches. Proctoscopy showed a pale but otherwise normal mucosa. Examination of the colon by the x-ray revealed no other defects (Fig. 300). The tumor was removed successfully per anum by passing sutures through the healthy mucosa and dividing the pedicle in sections after each suture was tied. The patient was well and there were no signs of recurrence four years after operation (Fig. 301).

MULTIPLE ADENOMATA

The pathology, symptoms, course and treatment of this condition differ in so many important respects from simple adenomata, that it demands separate consideration as a distinct disease entity. True multiple adenomata or multiple polyposis is a comparatively rare condition but is the most important and serious type of innocent growth of the intestine. Children and young adults are most frequently affected. In Doering's series of fifty-two collected cases, the majority were children. Of forty-two cases compiled by Quénu and Landel, over 50 per cent were between twenty and thirty-five years of age. Approximately two-thirds of the cases occur in males. The youngest patients in the writer's experience were boys of five and seven years.

The most common site of multiple adenomata is the distal colon and rectum. In other cases the myriad tumors may literally stud the mucosa from ileocecal valve to anus, usually diminishing at the higher levels. In a review of thirty-four cases, Thorebecke found the rectum involved in twenty-three, colon and rectum in five, and colon alone in six. In some cases aggregations exist in the rectum, or in the sigmoid, the intervening mucosa being free of tumors.

Etiology.—In the early stages of multiple adenomata there is a diffuse marked hypertrophy of the epithelial lining (Ewing). This accords with the view of Verse that irritation (bacterial, chemical or mechanical) is a predisposing factor.

Clinical experience justifies the opinion that the greater number of these cases are inflammatory in origin. Evidence of this is the frequent history of colitis or dysentery preceding the development of the adenomata.

Ball and others have observed that the eggs of *Bilharzia hamatobia* deposited in the rectal mucosa set up an irritation and may give rise to adenomata. Fur-

ther support of the theory of irritation is the occurrence of the growths at the points of angulation and fixation where intestinal action is exaggerated, and their predominance in the rectum where formed feces cause maximum irritation. Positive evidence of the rôle of irritation in causation is furnished by therapy. In some cases retrogression or disappearance of the growths has followed the removal of the irritating substances by colonic irrigations or diversion of the fecal current through an ileostomy or colostomy. Some authorities, notably Meyer, consider that a congenital defect or predisposition of the connective tissue of the intestinal mucosa and submucosa is the basic cause; that the epithelial changes are secondary and inflammatory. The theory of a congenital defect or a preternatural sensibility of the tissues in consequence of which response to even the normal physiological processes is expressed in

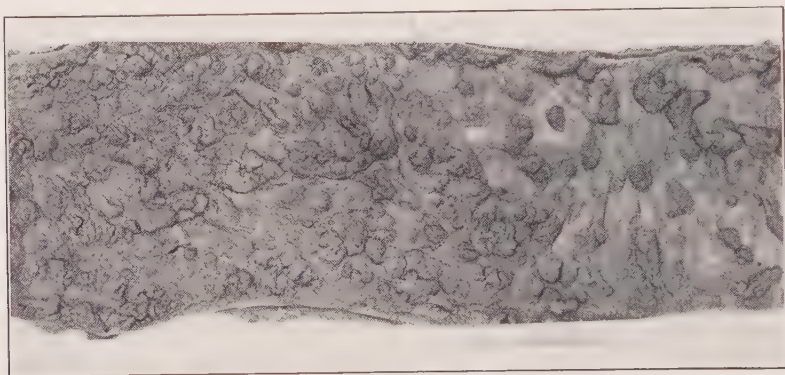


FIG. 302.—MULTIPLE POLYPOSIS OF COLON.

Many of the tumors are pedunculated. (City Hospital Museum, New York.)

hypertrophy and hyperplasia of the mucosa, either localized or general, furnishes a basis for the disseminated adolescent type of multiple polyposis without demonstrable gross evidence of associated irritation. A familial tendency, observed in several instances, favors this view. Cripps treated a boy twenty years of age, having multiple adenomata of colon and rectum, and subsequently removed adenomatous polyps from the rectum of a brother aged seventeen and a sister of sixteen years.

In 1839, Rokitansky interpreted the adenomata developing at the margin of healed ulcers as islets of mucosa caught by the cicatricial tissue in the process of repair. This mechanical separation of epithelial cells would seem to be a logical explanation of the "colitis polyposa cystica" described by Virchow, the functioning glands becoming cystic through obstruction of their orifices by contracting connective tissue. The many polypi noted by Mummery and others, as occurring in the immediate vicinity of old intestinal strictures and hyperplastic tuberculosis, are most probably secondary to irritation of the lesion with which they are associated.

The tumors vary markedly in size, form and appearance. At first, they are

mostly sessile, but in their later development many, in some cases the majority, become pedunculated, so that both varieties usually coexist. The pedicles usually are short and thick. The adenomata are smooth, round and shiny, or rough and wartlike. The color of recent growths is pink, but when old and inflamed they assume a dark red color. As a result of fecal trauma and hyperperistalsis, the surface of the tumors is frequently abraded and ulcerated. To palpation the tumors are usually soft at first. Later they may be hard as a result of inflammatory or fibrous changes, cystic degeneration or malignant transformation. In diameter they vary from 0.5 to 3 centimeters. The intervening mucosa usually shows chronic inflammatory changes.

The two essential elements composing the adenoma are the fibrous tissue stalk, derived from and continuous with the submucous connective tissue; and the epithelium covering this stroma which is continuous over the pedicle with the normal epithelial lining of the intestinal wall. In the adenomata, the glandular elements predominate while in papillomata the stroma is the chief feature.

Both the epithelium and the stroma participate in the diffuse neoplastic process which Ewing describes under the term "inflammatory adenoid hyperplasia." The gland cells show hyperplasia and hypertrophy; the stroma, infiltration with lymphocytes, and formation of new stroma cells, blood- and lymph-vessels. The change from this condition of simple thickening to definite sessile or pedunculated tumors is gradual and usually by slow transition.

Infiltration and edema in the areas of thickening, aided by mechanical traction, incidental to bowel function, are assumed eventually to cause these areas of thickening to protrude into the bowel lumen as definite tumors.

Symptoms.—Generally the course of the disease is slow but progressive, usually from one to five years, but may be longer. The four cardinal symptoms of multiple adenomata are diarrhea, hemorrhage, pain and depletion.

The uncontrollable diarrhea is accompanied by griping and tenesmus. The small soft stools contain mucus pus and blood. Occasionally constipation is present and straining may induce prolapse, or periods of constipation alternate with the diarrhea.

The secondary symptoms of ulceration, anemia and toxemia develop in due course. The degree and intensity of the symptoms naturally varies with the extent of involvement of the mucosa and the amount of ulceration present.

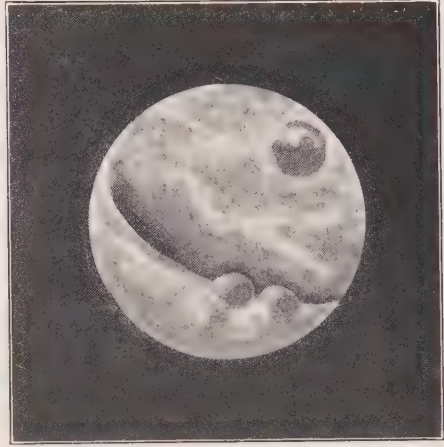


FIG. 303.—MULTIPLE SMALL SESSILE ADENOMATA OF RECTUM.

Two on margin of Houston's valve. Proctoscopic view.

Intestinal obstruction, due to intussusception or occlusion of the lumen by the growths, and malignant degeneration of the polypoid process are the two important complications.

Malignant Transformation.—As a result of the foregoing symptoms, multiple adenomata *per se* exert a malignant constitutional effect, but the chief danger of their neglect or improper treatment is their proneness to malignant degeneration. In fifty cases reviewed by Doering and eleven by Soper adenocarcinoma was present in twenty-six (43 per cent).

Struthers reported thirty-nine cases from the Mayo Clinic, twenty-two of which were operated upon, the specimens removed showing carcinoma in four instances. Warwick reported two cases (autopsy), both carcinomatous.

At the 1909 meeting of the American Proctologic Society, Tuttle reported eight cases of multiple polyposis, four of which in the hands of others, one in his own, developed malignancy after local treatment by snaring, curettage and cauterization; whereas in three children the growths were controlled by irrigation and snaring of the pedunculated forms. Of these children, irrigated through a cecostomy, one developed a recurrence five years later.

Analysis of a large number of recorded cases indicates a malignant change in approximately 50 per cent, which is much higher than that of any other benign process. Accumulating clinical experience tends to show that practically all cases of this type undergo malignant degeneration when allowed to take their natural course.

Nowhere else, according to Ewing, can the transition from simple inflammatory hyperplasia to tumors, pathologically cancerous, be more clearly demonstrated. Both clinically and by histologic study of specimens, the changes may be traced through the stages of inflammation, gland-cell hypertrophy and hyperplasia, and adenoma to definite adenocarcinoma. It is a logical inference that continuance of the irritative factors that induce the adenomata stimulate epithelial hyperplasia until it breaks through normal bounds and becomes malignant.

In the case of adenomata assumed to arise secondary to a congenital defect of tissue or hypersensitive mucosa, irritation most probably plays an essential rôle, once the process has begun.

The colon and rectum which are the preponderant sites of intestinal adenomata, possess, in an exalted degree, all the mechanical and biochemical factors for irritation. On the other hand, polypi in other situations, notably of the nasal mucosa, where these factors of irritation are minimal, seldom if ever undergo malignant transformation.

In disseminated polyposis of the rectum and colon, carcinomatous change may occur in widely separated tumors. For this reason negative findings in a single excised growth do not exclude the possibility of others in the same case being malignant. The site of transition may, according to Ewing, begin at the base, tip or throughout a polypoid adenoma.

Metastasis to the abdominal lymphatics, liver, spleen and kidney have been noted.

Diagnosis.—The diagnosis is based on the history, frequently of a colitis and bloody discharge; and the findings on physical examination. Digital palpation will usually detect one or more tumors in the rectum, but proctosigmoidoscopy is essential when they are situated at a higher level. In no case should inspection be omitted to determine the number, size, character and distribution of the growths.

In cases of segmental or disseminated polyposis of the colon, the x-rays frequently show a striking and characteristic picture (Fig. 304). The rays are also invaluable in demonstrating associated lesions as chronic ulcerative colitis, multiple diverticulitis and obstruction.

Biopsy.—In rare instance a biopsy is essential for a positive diagnosis. Pathologists and surgeons are now quite generally agreed that in doubtful cases the advantages of a positive diagnosis outweigh by far the danger of aggravating a malignancy by trauma. A specimen of tumors accessible through the proctoscope is readily obtainable by the author's biopsy forceps.

Treatment.—The ideal of treatment is removal of the adenomata in their benign state. When the tumors are associated with chronic ulcerative colitis, a stricture or tuberculosis, treatment is directed to these presumably causative lesions. Tumors in the rectum and sigmoid, accessible through the proctoscope should be snared off. Snaring and cauterization may result in a cure. Moreover, it should precede more radical intra-abdominal operations, for even when



FIG. 304.—MULTIPLE POLYPOSIS OF COLON.
X-ray shadows of polypoid structures. Female, aged twenty-four. (Radiogram by Wm. H. Stewart.)

colectomy is performed, unless the tumors in the rectum have been removed, the symptoms persist in a modified form. The patients must be kept under observation and if malignancy develops, excision of the rectum must be performed.

In the disseminated type the prognosis is best when the growths are localized to a segment of the bowel that can be excised. This entails a partial or total colectomy which the depleted condition of the patient may interdict. Unfortunately, after opening the abdomen, it is difficult and often impossible to deter-

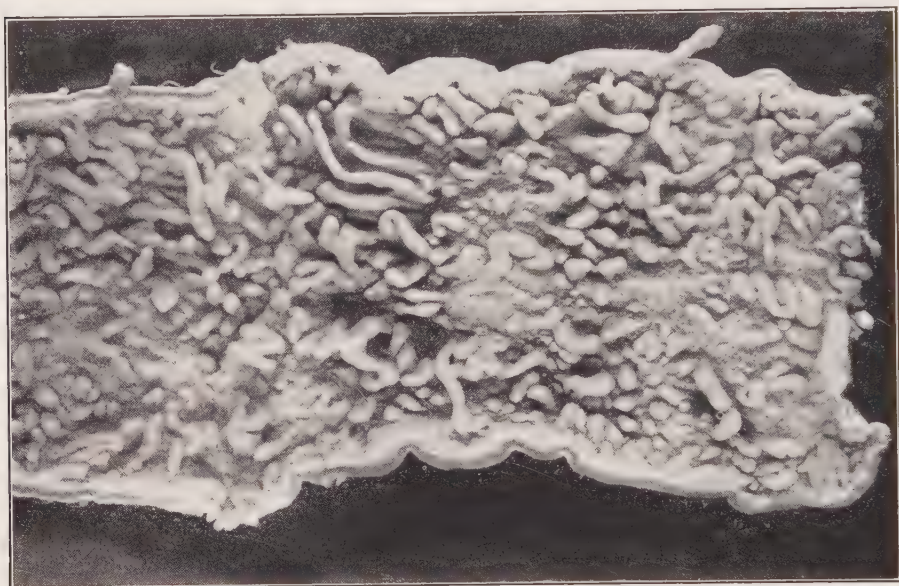


FIG. 305.—MULTIPLE POLYPOSIS OF ENTIRE COLON.

Female aged twenty-four years. Total colectomy by Howard Lilienthal in 1900. First successful operation reported for this condition. Patient well twenty-seven years later.

mine by palpation of the gut, the extent of involvement by small disseminated tumors.

Less radical operative procedures that can be performed safely under local anesthesia are: Appendicostomy or cecostomy for irrigation; ileostomy by the Brown technic to divert the fecal current and for colonic flushing; and ileo-sigmoidostomy. These measures are largely palliative but in some instances the tumors are held in check or regress and the general condition of the patient is so improved that colectomy can be undertaken with more favorable prospects of success.

Successful colectomies are reported by Lilienthal, Soper, Mayo, Erdmann, Mummery and others. Lilienthal's case was remarkable and at the time unique, being the first colectomy of record for this condition. The patient was a woman twenty-one years of age. In 1899 Lilienthal did a cecostomy, marked benefit resulting. Three months later he implanted the ileum into the lower portion of the

sigmoid and in June, 1900, he did a total colectomy (Fig. 305). Six months later, he reported the patient as being perfectly well, and during the succeeding period of twenty-seven years, to date, she has had no annoyance referable to her intestines, which function normally once or twice daily.

Because of the anemia and toxemia the operative *mortality* is high. Of fourteen cases reported by Struthers, five died, the operations being ileostomy, colostomy, or colectomy. Of four cases of polyposis personally observed, one developed carcinoma.

Case.—J. T., male, aged twenty-nine, had a history of dysentery of fourteen months' duration, before consultation. Bowel movements then averaged fifteen daily, and considerable mucus, pus and blood were discharged. Weight loss was 10 pounds. He was anemic and felt very weak. Proctoscopy showed multiple adenomata varying in size from a pea to a hazelnut, and extending beyond the reach of the tube. During the ensuing month he lost 10 pounds in weight in spite of local and constitutional treatment. A colostomy was made in the transverse colon, as no tumors were palpable through the bowel wall above the sigmoid. Unfortunately, when the gut was opened on the fifth day it was found that the adenomata extended to the hepatic flexure and presumably to the cecum. By irrigations through the colostomy the greater number of tumors distal to the stoma disappeared and those remaining regressed. The growths proximal to the stoma were influenced to a lesser degree, yet the patient regained his weight and strength and carried on his usual occupation for three years. Then intractable diarrhea occurred through the colostomy and in response to the patient's urgent request for radical relief an ileostomy was established. Uncontrollable discharge through the ileostomy rapidly sapped his vitality and he succumbed three weeks later.

The excised colon distal to the colostomy was contracted, its wall thickened and leathery and many small adenomata studded its mucosa. The proximal colon showed adenocarcinomatous degeneration of large areas while many unchanged adenomata were still present.

Radium and x-rays have been tried. Diminution in the size of the tumors and partial alleviation of symptoms have been noted but no case has been reported as cured.

LIPOMATA

Lipomata rank next in frequency to adenomata among benign intestinal tumors. Of Dewis' 219 cases, forty-four were lipomata, six of which were in the rectum, five in colon and two in cecum. Stetten collected seventy-two cases of submucous lipoma; thirty-one were in the small and forty-one in the large bowel. The location of thirty of the latter was: Cecum, six; colon, ten; pelvic colon, seven; rectum, seven. A lipoma is made up of moderately firm, lobulated masses, consisting of rather coarse fat-cells supported by a fibrous stroma, and is encapsulated. The vascular supply is limited.

Two forms are recognized: (a) The *submucous*, arising from the connec-

tive tissue beneath the mucosa, and (b) the *subserous*, developing in the connective tissue beneath the peritoneum, the fatty tissues in the mesentery or the appendices epiploicæ. The subserous variety generally become pedunculated, are of considerable size, and may detach themselves, becoming free bodies in the peritoneal cavity where they frequently become calcified.

Submucous lipomata tend to become pedunculated, the pedicle usually being short or up to 3 inches in length. The average size is that of a walnut but much

larger tumors have been reported, 12 by 6 centimeters (Tedenat); 13 by 6 centimeters (Castellane). The overlying mucosa is atrophied and rarely ulcerated. Lipomata are prone to occur in adult life, fifth to seventh decades, when there is a general increase of fatty tissue, are many years in their development and do not change their character.

Symptoms.—Lipomata in the bowel wall may be symptomless or the symptoms are vague. When of sufficient size, submucous lipomata by encroaching on the lumen, cause obstructive symptoms. A lipoma in the rectal wall between the mucosa and muscularis, is ordinarily closely attached and may produce prolapsus, as occurred in Voss' case.

Invagination occurs in more



FIG. 306.—LIPOMA SIZE OF A LEMON, ATTACHED TO LEFT MARGIN OF ANUS.

Another smaller lipoma on left buttock. Patient, female, aged fifty-six.

than one half of the cases presenting symptoms, and in several instances a lipoma has been found at the apex of an intussusception. In one of Stetten's cases, a fist-size tumor attached to the descending colon protruded from the anus. The symptoms in rectal cases are tenesmus of several years' duration, colic, constipation or diarrhea with mucus and blood in the stools, and digestive disturbances. When situated in the sigmoid the symptoms may mimic a carcinoma and the tumor be palpable in the abdomen.

John Douglas reported such a case in a woman of forty-one years, complaining of lower abdominal pain, constipation and at times abdominal distention.

A mass was palpable in the left inguinal region and radiographic examination showed a filling defect in the sigmoid flexure. A diagnosis of carcinoma of the sigmoid was made both before and at operation. Of the sigmoid, 16 centimeters were resected with end-to-end anastomosis of the bowel. After another operation to close a small fistula that formed, the result was entirely successful. The removed specimen showed the tumor to be a submucous lipoma, partly obstructing the lumen, and the covering mucosa was ulcerated (Fig. 307).

In 1924, F. and A. Derocque collected 104 cases of intestinal lipomata from the literature and added one of their own. In only seven were multiple tumors found. The tumors were symptomless in 9 per cent of those occurring in the large intestine. In thirty-one cases, both large and small intestine, acute occlusion occurred, and in fifty-six cases the symptoms were chronic. In the seventy-two cases in which the tumors caused symptoms, intussusception had occurred in 88 per cent of the thirty-two small intestine cases, and in 50 per cent of the thirty-eight large intestine cases.

Diagnosis.—When situated in the rectum, the finger can feel the tumor and in a number of cases the invaginated neoplasm has been felt in this situation. Proctoscopy and roentgenologic examination should be done to detect tumors in the sigmoid or higher levels. A correct diagnosis is seldom made before extirpation, although the smooth mucosa overlying the tumor may present a distinct yellowish cast which is very suggestive. In the cases presenting symptoms, the prognosis is good with early surgical intervention.

Treatment.—Pedunculated lipomata should be ligated before ablation because of the possibility of peritoneal invagination into the pedicle. When the tumor is situated in the rectal wall and is not pedunculated the overlying mucosa is incised, the lipoma enucleated, and the wound sutured, if possible. If the



FIG. 307.—SUBMUCOUS LIPOMA OF SIGMOID.
Mucosa ulcerated over tumor. (Courtesy of John Douglas.)

tumor, protruding through the anus, invaginates the sigmoid, resection and end-to-end anastomosis may be performed. A lipoma in the sigmoid, mimicking cancer in its symptomatology and gross appearance, is removed by resection and end-to-end anastomosis.

LEIOMYOMATA

In 1910, Descoudres collected from the literature eighty cases of myomata of the intestinal tract, sixteen of which were in the rectum. The distribution of the forty cases collected earlier by Dewis was: Small intestine, seventeen; vermiform appendix, one; cecum, three; colon, four; sigmoid, one; intestine (unidentified), four; rectum, ten.

The tumors are usually single and may be intraluminal and pedunculated or develop external to the bowel wall. In Dewis' group, the tumor of the sigmoid was external; in the rectum, five (two in one case) were internal, and six external, three of the latter growing from the rear of the bowel. A single growth is the rule, but exceptionally there may be two or more.

The tumors arise from the muscular coat of the bowel and are composed of smooth muscle or combined muscle and fibrous tissue.

Histologically the tumor consists of spindle-shaped, non-striated muscle-cells arranged in bundles, their long axis parallel. The supporting network is connective tissue, and when this is in considerable quantity, the tumor may be termed a fibromyoma. Rarely glandular elements are included in the tumor constituting it an adenomyoma. The blood supply is scant. Consequently growth is slow, many years in duration, or may entirely cease; or the tumor may undergo fatty or hyalin degeneration, necrosis or calcification. Myomata usually occur in adults, although Carlier found a pedunculated intraluminal myoma in a child aged four years. Of twenty-three cases reported from the Mayo Clinic, ten were males and thirteen females.

Their ages by decades were:

<i>Age</i>	<i>Cases</i>
21-30	2
31-40	6
41-50	10
51-60 ...	3
60 plus	2

The oldest patient was eighty-five years of age and the youngest twenty-one.

The tumors may be small or very large. In Descoudres' case the tumor, the size of a coconut, presented at the buttock and interfered with sitting.

Hill's case of pure myoma occurred in a man, aged thirty-six years. The important symptoms were progressive constipation of four years duration, rectal tenesmus while standing, and occasionally slight bleeding. A loss in weight of 30 pounds was attributed to drastic catharsis. The tumor was attached by a fan-shaped pedicle to the anterior rectal wall nearly 4 inches above the

anus. After transfixion and ligation of the pedicle, the tumor was removed successfully. The mushroom-shaped growth measured $3\frac{1}{2}$ by $2\frac{1}{2}$ by 2 inches.

The external variety of myomata may be of very large dimensions. Westermarck reported a case of his own and cited one of Senn in which they removed fibromyomata from outside the rectum, but closely attached to its anterior wall. The large tumors partially filled the pelvis.

In Berg's case, cited by Westermarck, the tumor filled the sacral concavity, and was closely attached to the rectal wall, the mucosa of the gut being inflamed, thickened and ulcerated. The growth was removed by a Kraske operation. In a similar case, McCosh, after a preliminary colostomy, excised the coccyx and removed the tumor together with the portion of rectal wall to which it was attached. His patient made a good recovery.

Symptoms.—The chief symptoms noted are progressive constipation (obstipation), pain and occasionally bleeding. If situated within the rectum, frequent desire to defecate, with small passages containing mucus and rarely blood, may be noted. Bleeding is not characteristic as the mucosa does not ulcerate early, thus differentiating myomata from malignant neoplasms, except the rare sarcomata. Positive diagnosis can only be made on microscopic sections.

Treatment.—If the tumors cause symptoms, free local removal is indicated. If portions of the tumor are left there is a tendency to local recurrence. Preferably this operation should be done from outside the rectum, the coccyx being excised to facilitate approach. After removal of the growth, the muscular coat of the gut at the site of removal should be closed by suture. If the tumor is enucleated within the rectum, free drainage must be provided.

ADENOMYOMA OF THE RECTUM

In 1916, Cullen reported fifteen cases of adenomyoma of the rectovaginal septum: Five of his own, Stephens five, Jessup two, Lockyear two, and Nadel one. The origin of these tumors is not always clear. They develop in the triangular space between the rectum behind, the cervix and body of the uterus in front, and the peritoneum above. Extension may take place forward into the uterus, laterally into the broad ligaments or backward into the rectum. The author's interest in adenomyomata is due to the following case which appears to be unique.

Mrs. V., aged thirty-seven, mother of two healthy children, consulted the author in September, 1916, because of rectal hemorrhage, and pain. Menses were painful and the flow gradually ceasing, no leukorrhea. Prior to three years before she was always constipated. She then had an attack of diarrhea lasting five months. Thereafter intermittent attacks occurred, and during the previous year, stools had averaged ten to twelve daily, containing fresh blood and mucus. During the past three years she had pain over the lower sacrum, aggravated at the menstrual period and with the diarrhea. Physical examination was negative except the local condition. Hemoglobin, 85 per cent. Wassermann of

the blood, negative. Rectal examination: $3\frac{1}{2}$ inches above the anus on the anterior rectal wall, just above the cervix uteri, the finger felt a hard, fixed, fairly tender mass, the limits of which could not be very clearly defined. The overlying mucosa was not movable. Proctoscopy showed a superficial ulceration, $2\frac{1}{2}$ centimeters in diameter, at the rectosigmoidal juncture, which was red and clean and bled freely on contact.

Vaginal examination: Uterus normal in size and position and movable. The lateral fornices were clear, but in the posterior fornix was felt the same hard, tender, slightly movable mass, the size of a guinea-hen's egg, as was felt per

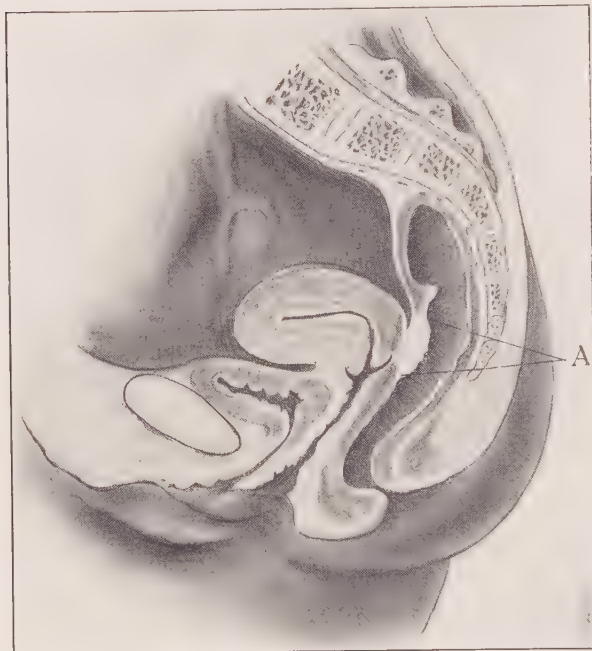


FIG. 308.—ADENOMYOMA OF RECTUM.
Female, aged thirty-seven.

rectum. Operation on September 26, 1916. Left rectus incision. The sigmoid flexure was very long, as indicated by the x-ray, and contained an excess of yellow fat. The tumor was situated in the anterior wall of the sigmoid, just above its juncture with the rectum, and extended downward 2 inches onto the rectum, cervix uteri, and posterior vaginal wall. Lower third of sigmoid was mobilized, including a small portion of the posterior wall of the uterus and its cervix, and the superior hemorrhoidal artery was ligated. The abdominal wound was then closed, and, in the lithotomy position, the operation was completed by

a typical Quénu-Tuttle extirpation of the rectum, including the posterior vaginal fornix, $1\frac{1}{2}$ by 2 inches, which was involved in the growth. The sphincter ani was preserved and the sigmoid sewed to the perianal skin, thus forming the new rectum (Fig. 308).

Patient left the hospital three and one-half weeks after operation and now, twelve years later, is well, having normal anal sensibility for bowel actions, which occur once or twice daily with normal control. Vaginal and rectal examination show no abnormalities.

After careful study of the gross tumor and microscopic sections, James Ewing reported: "Your intestinal tumor is an adenomyoma and its close incorporation in the muscle coat of the rectum indicates that it belongs originally

with the portion of muscle tissue. The most likely origin is from superfluous material derived from that portion of the lower gut which continues on in the embryo to the bladder and allantois, and which normally atrophies. Persistence of a portion of this segment would furnish a source of smooth muscle and intestinal epithelium. I do not think the tumor is of Müllerian origin" (Fig. 309).

Symptoms.—Varying with the stage of development and situation of the growth, the symptoms are (*a*) obstructive, (*b*) dysenteric, when the mucosa



FIG. 309.—ADENOMYOMA OF RECTUM.
Photomicrograph of non-ulcerated area.

is ulcerated, and (*c*) neuralgic, when sensitive nerves are compressed, evidenced especially by sacral and rectal pain.

Diagnosis.—Unless the examiner were forewarned by previous experience it is doubtful if he would even consider the possibility of adenomyoma in the diagnosis. Both of the cases of adenomyoma of the rectovaginal septum reported by Jessup had been pronounced inoperable "on account of the apparent involvement of the rectum by a malignant growth."

Other rare lesions to be thought of in the differential diagnosis are sarcoma of the rectum, and implantation of carcinoma in the *culdesac* of Douglas, styled the "rectal shelf" by Blumer and British authors.

Histologically benign, adenomyoma may, as in the case reported, exert a clinically malignant influence on the organism, or undergo malignant degeneration.

Surgical removal is indicated as the only curative therapy.

FIBROMATA

True fibromata of the rectum are very unusual.

In Dewis' review of 219 benign intestinal tumors, only five were fibromata: Two in the ileum, one colon and two in the rectum. The latter were Harteux's cases. In Bowlby's patient, a woman, the tumor, extruded at stool, was the size of a fetal head and weighed nearly 2 pounds. It was attached by a pedicle to the anterior rectal wall 4 inches above the anus. An excellent recovery followed ligation of the pedicle and ablation of the tumor which microscopically was composed almost wholly of fibrous tissue.

Fibromata arise from the submucous connective tissue and may be solid or cavernous.

The fibrous tissue of true fibromata is arranged in wavy bundles and the blood supply is scant. They may develop and remain in the rectal wall or become pedunculated.

The relatively common so-called fibrous polyp of the rectum is in reality not a true fibroid but a polypoid tumor in which fibrous tissue is mixed in varying proportions with glandular and other elements.

In consistency fibromata may be hard or soft, varying with their structure. They are covered with mucosa, encapsulated, slow growing and benign in their clinical course except for the mechanical interference they may cause. When a fibroma remains in the rectal wall it grows expansively, assuming the form of a spherical or ovoid mass closely adherent to the muscular coat and the mucosa is movable over it. In the region of the anal canal a single or multiple fibromata may occur. The latter are usually due to hypertrophy of the papillæ, normally found on the valves of Morgagni. The other type usually develops on chronic internal hemorrhoids which have become thrombosed and tend to prolapse through the anus.

The symptoms of a pedunculated fibroma within the rectum are chiefly mechanical and irritative. Fibromata developing on internal hemorrhoids and hypertrophied anal papillæ are pedunculated. The symptoms are tenesmus, protrusion at defecation and mucus in the stool. Diagnosis is simple by inspection and palpation. The treatment is by excision.

Molluscum fibrosum or Recklinghausen's disease, characterized by multiple neurofibromata of the skin, may rarely present an associated multiple fibromata of the rectum. In 1903, A. B. Cooke reported this unusual combination in a

white man, aged forty-three. When a boy of thirteen he had constipation and prolapse of the rectum which operation did not cure. During the five years before coming under Cooke's care the patient suffered intractable diarrhea, with discharge of mucus, blood and pus. He became emaciated and bedridden and the diagnosis of cancer was made. Examination showed relaxed sphincters and the rectum filled with tumors, many of which were ulcerated. The tumors situated in the mucosa varied in size from a birdshot to an almond. The larger growths were pedunculated, the smaller sessile. Small tumors were scattered in the pelvic colon. More than sixty distinct tumors were removed at several sittings by forceps and curet, the patient eventually making a good recovery. Many tumors removed from the skin showed the same histologic structure as the rectal fibromata, but the proportion of fibrous tissue in the latter was greater.

ANGIOMATA

Very few cases of angiomas of the rectum have been reported. There were only three (two of the rectum, and one of the small intestine) in Dewis' collection of 219 benign intestinal tumors. The tumors appear to be congenital. They usually are composed of blood-vessels supported by a scant stroma of connective tissue. In the less frequent cavernous type, septa of connective tissue separate the large, irregular vascular spaces.

In 1883, Barker reported the case of a man, aged forty-five, who had occasional large rectal hemorrhages since boyhood. The patient died of uncontrollable hemorrhage. On postmortem, a nevoid growth of purplish color was found to involve the lower $4\frac{1}{2}$ inches of the rectal wall. Ulceration of the tumor caused the bleeding. Sections showed the tumor to be a cavernous nevus of the mucosa and submucosa.

Marsh reported a nevus surrounding the lower 4 centimeters of the rectum in a girl aged ten years who had rectal hemorrhages for eight years.

Mummery's patient was a man aged forty-one who had occasional alarming hemorrhages from the bowel, dating from his nineteenth year, and supposed to be due to a duodenal ulcer. Sigmoidoscopy showed that most of the rectum and a portion of the pelvic colon to be involved in a large venous angioma, the veins equaling the little finger in size. The patient eventually died, as a result of a severe uncontrollable hemorrhage, probably due to rupture of one of these large veins.

The only important symptoms in these nevoid tumors of the rectum are hemorrhage, due to abrasion, ulceration or rupture of the vessels, and the consequent anemia.

Treatment.—In the emergency of an acute hemorrhage, local application of astringents and packing are indicated to control the bleeding, and transfusion of blood for the anemia. If the tumor is within reach, excision, as in the Whitehead operation for hemorrhoids, may be attempted. When this type of neoplasm involves a large area, Mummery suggests a preliminary colostomy and later

excision of the rectum, although dangerous hemorrhage may be encountered as the vessels of supply are very large.

Nevi occur at times on the perianal skin. Usually they are not important but Adler reported an interesting case in a man aged forty, in which the tumor was associated with internal hemorrhoids. A nevus of purplish hue about 2 inches in width and slightly elevated from the adjacent skin, surrounded the



FIG. 310.—PHOTOMICROGRAPH OF CONDYLOMA ACUMINATUM.

anus. After the sphincters were divulsed under general anesthesia, the nevus became markedly enlarged, standing out almost an inch from the surrounding parts. After removing the hemorrhoids, he made an elliptical incision around the nevus and excised the entire tumor, in one strip. Microscopically the blood-vessels, mostly veins, were fully formed, dilated, many to a very large size, and showed moderate hyperplasia of their walls. No blood-spaces were seen. The patient stated that he had been greatly annoyed since birth by an external fullness in the anal region which was at times decidedly increased when walking and at stool.

ANAL WARTS

These growths, known also as papillomata, verruca and condylomata, occur frequently around the margin of the anus and just within the anal canal. Due to their frequent association with venereal diseases, they are often called venereal warts. Apart from the condylomata lata, which is a secondary syphilid, these growths are not venereal and they do not respond to treatment for those conditions.

They arise from hypertrophy of the papillary layer of the skin and consist of connective tissue and blood-vessels covered with a stratified epithelium. This hypertrophy depends essentially on moisture. Hence any irritating discharge or chafing may cause them, as the discharge of leukorrhea, gonorrhea, hemorrhoids, proctitis, or especially *Oxyuris vermicularis* which should be searched for. No specific parasite or germ has been discovered as the etiologic factor. They are prone to occur in stout individuals where the parts are moist but seldom if ever in individuals who observe closely the rules of personal cleanliness. They appear as pinkish papillæ, closely set or scattered; or the wart-

like excrescences branch, rapidly intermingling with branches of other warts, and thus form a large cauliflower-like tumor, which in fact is attached to the skin by many pedicles.

This excrescence begins on one side of the anus, is usually of rapid growth and frequently surrounds the orifice, filling the intergluteal space. It is of pale, whitish color and the fetid discharge irritates the adjacent skin. Usually the exuberant growth is soft and pliable and bleeds freely when injured. In other



FIG. 311.—CONDYLOMA ACUMINATUM.

Boy aged nine years. Excised under local anesthesia and base phenolized. Cured.

cases, when the connective-tissue stroma is abundant and the covering epithelium thin, the tumor is dry and hard.

They occur predominantly in males during early adult life but sometimes in children (Fig. 311) and the aged. In the latter, the growths are thought to result from degenerative changes in the skin.

Symptoms.—The chief symptoms are the annoyance caused by the presence of the tumor and the irritation produced by the discharge. The growth is not

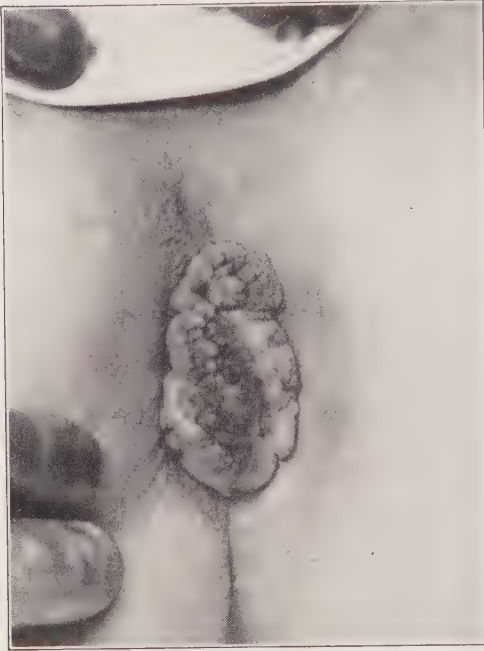


FIG. 312.—CONDYLOMATA ACUMINATA.
Woman aged thirty-two years.



FIG. 313.—CONDYLOMATA ACUMINATA.
Same case as Fig. 312. Left half of growth removed with electric cautery.

tender but when the anal canal is involved its mucocutaneous lining frequently becomes fissured and defecation is painful.

Diagnosis.—These growths present a characteristic appearance which makes diagnosis simple to one familiar with the condition. A possible error is in mistaking them for a fungating epithelioma. Absence of induration at the base or ulceration of the surface distinguishes them from epithelioma. If doubt exists, microscopic examination of a biopsy specimen is decisive.

Treatment.—It is essential to get rid of the discharge that originally caused the vegetations, if this be present. Scrupulous cleanliness and the application of calomel or zinc oxid powder on cotton may then be efficient.

The best operative treatment for small, isolated warts is to snip them off at the base with scissors and apply fuming nitric acid or trichloroacetic acid.

For large, exuberant tumors, the quickest and most effectual method is to anesthetize the patient and remove the entire mass at the base with the actual cautery. Every isolated wart, however small, must be seared. Vaseline gauze is applied as the first dressing and powders thereafter. Healing is prompt and usually there is no recurrence. Fulguration is recommended by some writers. Treatment by the x-ray is not efficient or satisfactory.

REFERENCES

- ADLER, Lewis H., Jr. *Tr. Am. Proctol. Soc.*, 1909.
 BALL, Sir Charles B. *The Rectum*, London, Oxford University Press, 1909.
 CRIPPS, Harrison. *Diseases of the Rectum and Anus*, 3rd Ed., Chicago, W. T. Keener and Co., 1907.
 CULLEN, Thos. S. "Adenomyoma of the Rectovaginal Septum." *J. Am. M. Ass.*, Chicago, Vol. 67, Aug. 5, 1916.
 DEROCQUE, F. and A. *J. de chir.*, Paris, Vol. 24, Aug., 1924.
 DESCODRES, F. "Des Myomes du rectum," *Rev. de gynéc. et de chir. abd.*, Paris, 1910, Vol. 14, No. 5.
 DEWIS, J. W. *Boston M. & S. J.*, 1906, Vol. 155, No. 16.
 DOERING, H. *Arch. f. klin. Chir.*, Berl., 1907, Vol. 83.
 DOUGLAS, John. "Lipoma of the Large Intestine, Resection." *Ann. Surg.*, Phila., 1926, Vol. 84, No. 1.
 ERDMANN, J., and MORRIS, J. H. "Polyposis of the Colon," *Surg., Gynec. & Obst.*, Chicago, Vol. 40, April, 1925.
 EWING, James. *Neoplastic Diseases*, Philadelphia, W. B. Saunders & Co., 1922.
 HILL, T. C. *Manual of Proctology*, Philadelphia, Lea & Febiger, 1923.
 JESSUP, D. S. D. "Adenomyoma of the Rectovaginal Septum," *J. Am. M. Ass.*, Chicago, Aug. 1, 1914.
 KENNEDY, Roger L. J. "An Unusual Rectal Polyp: Anterior Sacral Meningocele," *Surg., Gynec. & Obst.*, Chicago, Dec., 1926.
 MUMMERY, P. Lockhart. *Diseases of the Rectum and Colon*, New York, Wm. Wood & Co., 1923.
 QUÉNU and LANDEL. *Rev. de chir.*, 1899, Vol. 19.
 SOPER, H. W. "Polyposis of the Colon," *Am. J. M. Sc.*, Philadelphia, 1916, Vol. 151.
 STETTEN, DeWitt. *Surg., Gynec. & Obst.*, Chicago, Aug., 1909.
 SAINT, J. H. *Brit. J. Surg.*, Bristol, Aug., 1927.
 STEWART, J. *Path. & Bacteriol.*, 1922, Vol. 25.
 STRUTHERS, J. E. "Multiple Polyposis of the Gastrointestinal Tract," *Surg., Gynec. & Obst.*, Chicago, Vol. 38, May, 1924.
 THOREBECKE, W. *Deutsche Ztschr. f. Chir.*, Leipzig, 1914, Vol. 126.
 TUTTLE, James P. *Diseases of the Anus, Rectum and Pelvic Colon*, New York, D. Appleton & Co., 1906.
 VERSE, M. *Arch. a. d. Path. Inst.*, Leipzig, 1908, Vol. 1, No. 5.
 WARWICK, M. *Minn. Med.*, Jan., 1922.
 YEOMANS, F. C. "Malignant Degeneration of Papillomata and Ulcers of Rectum and Colon," New York, *Arch. Clinical Cancer Research*, Jan., 1925.
 ——— Adenomyoma of the Rectum, *Med. Rec.*, N. Y., Sept. 29, 1917.

CHAPTER XXVII

SACROCOCCYGEAL DIMPLES, SINUSES, CYSTS AND TUMORS; CAUDAL APPENDAGES

DIMPLES AND SINUSES

Postanal dimples (coccygeal sinus, pilonidal cyst) are the most common variety of developmental anomaly found in the sacrococcygeal region. They are situated in the midline over the coccyx and lower sacrum. In approximately 30 per cent of infants there is, at birth, a sinus in this situation which is usually obliterated in growth. These congenital depressions are due to faulty coalescence of the ectoderm at this point during embryonic development. They persist in about 4 per cent of otherwise normal subjects, with a marked predominance in



FIG. 314-A.—CONGENITAL POSTANAL
FISSURE.



FIG. 314-B.—CONGENITAL POSTANAL
DIMPLE.

(Markoe and Schley, *Am. J. Med. Sc.*, May, 1902.)

males. The sinuses may be single or multiple, oval or linear in shape and extend from a few millimeters to an inch or more beneath the surface of the skin (Figs. 314-A, B). The sinus is lined with normal skin, and as a rule, if shallow, requires no treatment other than cleanliness.

In a few cases the dimple is exaggerated into a cyst, and nearly all are found in hirsute youths of dark complexion inclined to obesity. The cyst extends upward a varying distance, ending in a blind pouch over the supraspinous ligament of the sacrum. The cysts may persist for many years without symptoms. Their position, however, predisposes them to trauma and infection.

The pent-up secretion of the cutaneous lining, sebaceous and sweat glands, hair and bacteria eventually, in many cases, set up an inflammation and abscess formation. The pus discharges through one or more of the congenital openings, or frequently breaks through the cyst wall and opens on the surface some distance from the midline. Immediate relief of the acute symptoms results, but, unless there is surgical intervention, the same cycle of events is usually repeated.

Generally advice is not sought until infection has occurred. *Examination*

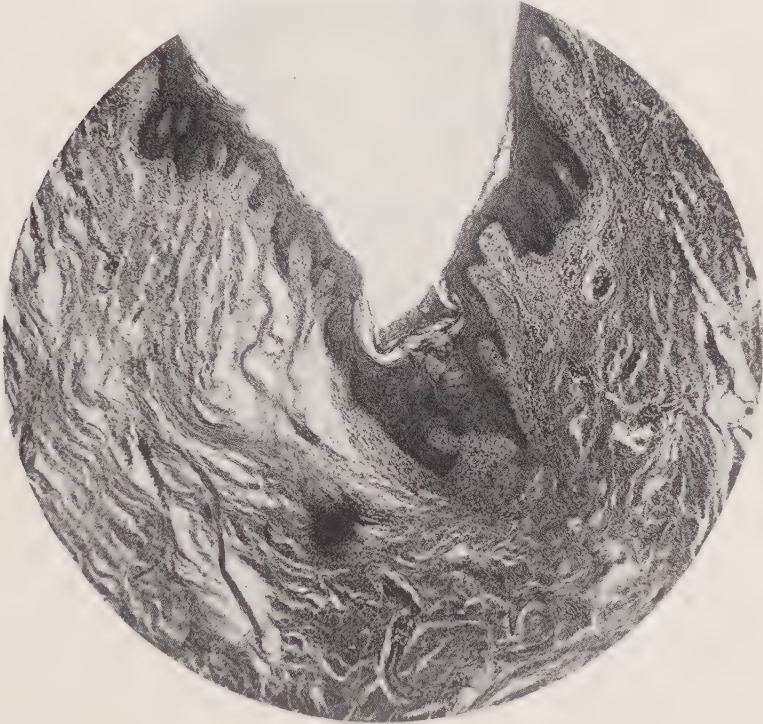


FIG. 315.—PHOTOMICROGRAPH OF TRANSVERSE SECTION OF AN EXCISED PILONIDAL SINUS, SHOWING THE CUTANEOUS LINING.

then shows an irregular, boggy, inflammatory, tender swelling over the lower sacrum and coccyx. The overlying skin may be intact but frequently it presents one or more fistulous openings lateral to the midline from which discharge can be expressed. Close inspection will usually show in the midline from one to five minute, funnel-shaped sinuses, lined with epithelium. Short, bristly hairs frequently protrude from these openings and when found are pathognomonic. The multiple sinuses communicate with the same blind pouch. Occasionally cystic dilatations are found, usually at the bulbous end of the tract, but they may occur anywhere along its course and demand great care in their excision.

Histologically these sinuses and cysts are lined with stratified squamous

epithelium, which may be modified in appearance as a result of inflammation. There is commonly found one or more locks of hair in the sinuses, and sinuses containing hair are called pilonidal sinuses or cysts (Fig. 316).

Diagnosis.—Discovery of the small mesial sinuses lined with epithelium establishes the diagnosis. A fine probe passed through one of these openings may show the cyst to be shallow or 2 or 3 inches in length. In case a pathological collateral opening is present, colored fluid injected into it promptly appears at the midline. Until comparatively recently the true nature of the condition was

not generally recognized. Under the mistaken diagnosis of infected sebaceous cyst or abscess complicating a rectal fistula they were and still are incised on one or several occasions with prompt relief of the acute symptoms but they almost invariably recur after the wound has healed.

In rare instances the sinus may extend into or through the sacral vertebræ, and communicate with the dura mater. Moise has recently reported an unusual case of this kind in a boy aged eighteen years, who developed a staphylococcus meningitis. A sinus extended through the junction of the first and second sacral vertebræ to the dura, representing a persistence of the embryonic neural canal. Laminectomy was performed with recovery.

The remote possibility of a congenital sinus or cyst communicating with the dura, or perhaps with a meningocele, should be borne in mind in making the differential diagnosis. If the conditions

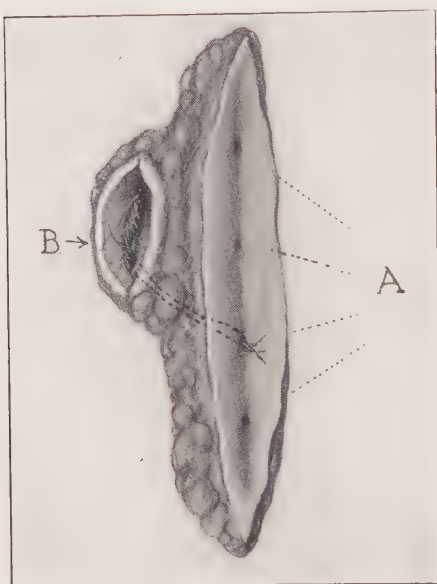


FIG. 316.—PILONIDAL CYST EXCISED
INTACT.

Note, *A*, the four skin sinuses from one of which hair is protruding, and *B*, the nest of hair in the bottom of the opened cyst.

suggest such a possibility a preliminary x-ray is valuable in excluding spina bifida.

Treatment.—This consists in radical removal. Injections of phenol, caustic pastes or curettage are mentioned only to be condemned. If active infection is present, the cyst should be irrigated with antiseptic solutions and drained for a few days until this subsides. Local infiltration anesthesia is satisfactory for the operation which is carried out under strict aseptic precautions. The tract is first flushed with 95 per cent phenol, followed by methylene-blue solution to insure removal of all pathologic tissue. A bent probe is next passed through the tract as a guide and for traction. The entire area involved is then excised *en bloc* by an elliptical incision deepened to the supraspinous ligament (Figs. 317-A, B, C).

Every vestige of the tract, as indicated by the methylene-blue stain of the tissue, must be eradicated; otherwise recurrence is certain.

Occasionally when the sinus or cyst is small and infection slight, the clean wound resulting from the excision may be closed by heavy silkworm sutures passed beneath the depth of the wound, and primary union obtained.

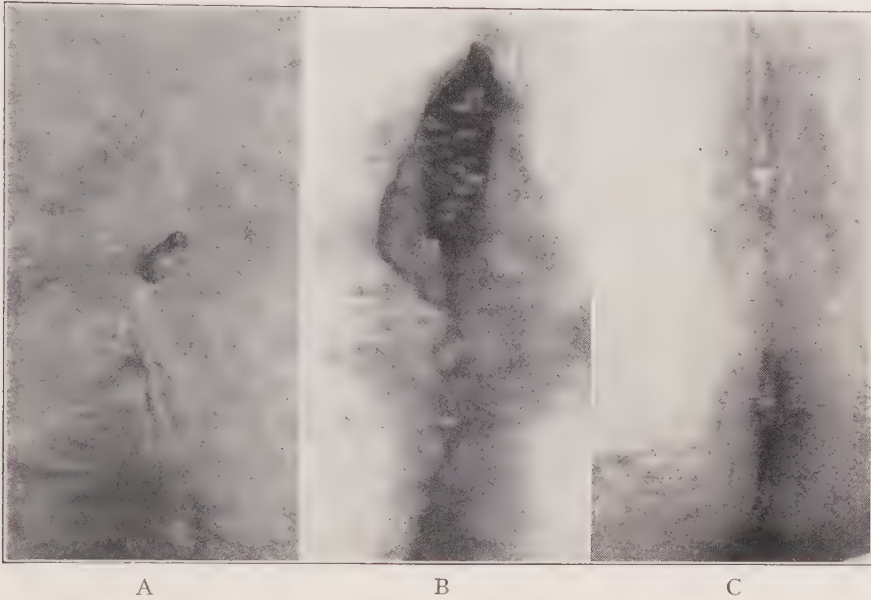


FIG. 317.—PILONIDAL CYST. MAN, AGED TWENTY-SIX.

- A.* Abscess had been incised three times during previous two years.
- B.* Appearance five days after excision of cyst.
- C.* Same case, wound nearly healed.

Frequently the closed wound becomes infected from the strong tension required to keep the surfaces in apposition and the sutures must be removed promptly lest deep suppuration spread beneath the gluteal fascia. As a rule, the best results, with shortest confinement, are obtained by packing the wound and healing by granulation, the patient being ambulatory.

CYSTS AND TUMORS

Although any type of tumor may occur in the sacrococcygeal region, the majority of them are congenital neoplasms arising from vestiges of embryonal structures in the caudal pole of the embryo which offers many opportunities for developmental error.

The derivation of these tumors is an interesting subject. Bland-Sutton's theory of embryological formation of neoplasms in this region follows: "In the early embryo, the central canal of the spinal cord and the alimentary canal

are continuous around the caudal extremity of the notochord. The passage which unites them is known as the neurenteric canal. When the proctodeum invaginates to form part of the cloacal chamber it meets the gut at a point some distance anterior to the spot where the neurenteric canal opens into it; hence there is for some time a segment of intestine extending behind the anus and termed in consequence, the *postanal gut*. Afterward this postanal section of the embryonic intestine disappears, leaving merely a trace of its existence in a small structure at the tip of the coccyx, known as the coccygeal gland or gland of Luschka."

"Tumors which arise in the postanal gut exhibit a definite structure. They are composed of closed vesicles lined with glandular epithelium, and contain glue-like fluid. Many of these tumors are composed of cysts and duct-like passages lined with cuboidal epithelium, held together by richly cellular connective tissue. The cysts are filled with ropy mucus, vary in size, and many contain intracystic processes."

The embryonic tissue thus left is a fertile source of tumors of the congenital cystic variety. The chief embryologic origins of tumors in this region are: Fetal inclusions and dermoid cysts; tumors arising in remnants of the postanal gut; and tumors of the neurenteric canal, the latter recently emphasized by Hansmann.

It is believed that the majority of presacral tumors arise in remnants of the postanal gut. This entodermal structure is, in the embryo, intimately related to the neurenteric canal, an ectodermic structure, surrounded by mesoderm.

With this in mind, it is easy to understand why tumors in this region may comprise derivatives from one or all three of the germinal layers, and offers a plausible explanation for the majority of teratomata with their great variety of tissue.

Sacrococcygeal tumors are generally referred to as congenital. They admit of no rigid classification owing to their structural complexity, the heterogeneous types of rudimentary tissue present, doubt as to their malignancy, and discussion as to their embryological origin. The diagnosis is often in doubt until operation, biopsy or autopsy reveal their true nature.

The more common types of neoplasms found in this region are dermoids, sarcomata in different forms, and teratomata. Less common are gliomata, chordomata, neurofibromata, chondromata, endotheliomata and carcinomata. The most common type seems to be a sarcomatous degeneration of fibrous tissue.

Congenital tumors in this region may be situated upon the posterior surface of the sacrum or be intrapelvic. The latter predominate and frequently have a sacral attachment which may also involve the neural appendages of this region.

On account of the tendency of intrapelvic growths to invade the rectum from the presacral, the rectovaginal or pelvirectal spaces, they often initially refer their symptomatology to the rectum. They are of greater clinical significance than the external variety. In certain cases they may give the impression

that they are tumors arising in the rectum proper and differentiation of their intra- or extra-rectal position is at times difficult.

The majority of postsacral or postcoccygeal tumors are small dermoids, epidermal cysts or sequestration dermoids which some authors attribute to an epithelial inclusion at the site of ectodermal coalescence, rather than to fetal vestiges.

Sacrococcygeal tumors of the congenital type are extremely rare, according to Calbet one in 34,558 births. In a series of collected cases 126 were in females and sixty in males. They are very unusual in adults because many of the infants in which they were found were stillborn, and others died soon after birth owing to associated malformations or frailty. In Calbet's statistics 60 per cent died before the end of the second year.

The prognosis of this class of tumors is grave and the prospect still worse if we include those cases of spina bifida of the anterior wall of the sacrum; producing what appears to be a tumor of the rectum. As to operative treatment, Molk collected thirty-one cases with fourteen recoveries, and Calbet fifty-three cases with thirty-seven recoveries, a total of eighty-four cases with thirty-three deaths, or a mortality of 39.3 per cent.

Dermoids.—True dermoids of the rectum are very unusual and much less frequent than postrectal dermoids. Rectal dermoids must be distinguished from those which develop in the rectovaginal septum and the retrorectal space.

They usually arise in the rectal wall and may produce symptoms comparatively early. Protrusion of hair from the anus has been a rather interesting clinical finding. When pedunculated the tumors may protrude from the anus or produce signs of obstruction by invagination of the bowel wall.

Clutton's patient, a girl of nine years, suffered extremely with constipation, tenesmus, occasional blood loss, and at defecation a tumor presented at the anus. Pressure over the sigmoid elicited tenderness and a distinct tumor was palpable. After dilatation of the sphincters, the tumor was found to be attached by a double pedicle above the rectosigmoidal juncture. Each pedicle was ligated and the tumor removed. It was a typical dermoid cyst, covered with cutaneous tissue and hairs, and containing all the elements usually found in these neoplasms.

Post reported a somewhat similar case in a girl of sixteen years. Symptoms of obstruction and pain had existed for three months. A tumor protruded partly at stool and a tuft of long hair protruded from the anus. The growth was attached by two pedicles to the posterior rectal wall 3 inches above the anus. After ligating the pedicles the tumor was removed. It was about 2 inches in diameter and was composed of skin covered with hair and sebaceous follicles, enclosing fat and fibrous tissue, bone and a well-developed tooth.

Postrectal dermoids occasionally open spontaneously in the perineum, usually between tip of coccyx and anus, a fistula persisting. W. W. Keen reported such a case in a girl three and one-half years of age, and J. B. Murphy, one in a man of twenty years, the fistulous tracts being respectively 3 and 4 inches deep. In Keen's case the tract was lined with ciliated epithelium which argues

for its origin from the neurenteric canal. Excision was successfully carried out in each case.

Extrarectal dermoids may attain a great size. Page removed a dermoid cyst weighing 3 pounds from the hollow of the sacrum in a woman thirty-eight years old.

Dermoid cysts may also develop outside the anus. Duret's patient, aged thirty, had supposedly carried the cyst at the margin of the anus from birth. Examination of the excised tumor showed it to be a rare form of dermoid.

Clado has collected seven cases (five males) of dermoid cyst in the rectovesical septum posterior to the bladder. Cysts in this situation may rupture into the rectum or the bladder; when into the bladder, shed hair may be passed intermittently with the urine. In Ord's patient, a man of twenty-eight years, the dermoid cyst in this situation was 10 by 13 inches, weighed 14½ pounds and contained sebaceous material and hair.

Dermoids originating outside the rectum may, by ulceration or rupture, protrude into the lumen and give the impression of a growth of the rectum proper. Jardine reported such an occurrence in a girl of ten years. She discharged blood and pus with her stools and during defecation a mass of tufted hair protruded from the anus. Careful examination showed a rent in the rectal wall with ulcerated edges, through which the tumor protruded.

Dermoids of the ovary, which is their commonest intrapelvic situation, may invade the rectum or sigmoid and produce symptoms referable to these organs. In some cases obstruction has occurred during pregnancy and rectal dermoids have been passed spontaneously per anum. Clinically dermoids vary in size from small tumors to extensive neoplasms, are usually encapsulated, and may be pedunculated. The capsule is composed of a tough, modified skin studded with hairs, and the contents comprise a greasy sebaceous material, locks of hair, teeth and other tissues resembling a rudimentary organ, all varieties of which have been encountered. Malignant degenerative changes may take place.

Dermoids, if small, should be dissected out intact. The removal of the sac of large dermoids is facilitated by first evacuating their contents. Exposure of the tissues to the contents of a dermoid sets up a violent inflammatory reaction. Every portion of the cyst wall must be removed, otherwise the wound will not close or if it does the cyst will reform. Complete removal and not drainage is essential to cure.

Teratomata.—According to strict terminology, a teratoma is defined as a tumor mass containing the tissues and fragments of viscera belonging to a suppressed fetus and derived from all three germinal layers. There is, however, no sharp line of demarcation between dermoids, teratoids and teratomata. The complexity of these tumors has led to much confusion in the terminology and classification. Thyroid dermoid, a teratoid dermoid, congenital cystic sarcoma (Braun), embryoma and other complex composite names usually refer to the same thing.

The most common site of these tumors is the ovary and sacrococcygeal

region but they have been described as occupying almost every intrapelvic position, at times reaching huge dimensions and extending well up behind the pelvic peritoneum or into the abdomen. They are rather invasive tumors than infiltrative and as a rule do not metastasize, unless having undergone malignant change.

Histologically they are similar to but more complex than dermoids, appearing more or less cystic, multilocular and present a most surprising variety of embryonal rudimentary structures. They are frequently attached to the sacrum or one of the pelvic viscera and their ramifications may be quite extensive. Keen and Coplin described a case in which a fistula passed through the sacrum connecting the rectum with a congenital tumor over the sacrum. The fistula discharged fecal matter and resembled a rudimentary bronchus. Schramm reports a case of a tumor between the rectum and sacrum composed of fat, nerves, muscle-fibers, hyaline cartilage, areas resembling stomach, milk and sweat glands. Some tumors have been reported which contained a more or less rudimentary fetus, or the entire tumor may comprise a parasitic twin.

Sarcomata.—Sarcoma is the type of malignant tumors ordinarily found in the sacral region. They usually occupy the retrorectal space, arising from the periosteum of the anterior sacral wall. (See chapter on Malignant Tumors.)

Gliomata.—Although rarely found outside of the nervous system proper, gliomata have been reported in the sacrococcygeal region arising from the cord or having a connection with the dura. Their extradural location seems to be in dispute although Kimpton has reported a case located in the buttocks at the side of the coccyx and connected with the spinal cord.

Histologically they resemble a rudimentary spinal cord. Their malignancy varies. They do not metastasize but tend to recur locally following removal.

Chordomata.—These tumors are of comparatively rare occurrence and arise invariably from the extremities of the notochord. Stewart and Morin have reviewed fifty-two reported cases, twenty-five of which were situated at the sphenopalatine synchondrosis and twenty-seven in the sacrococcygeal region.

The tumor is usually encapsulated and separated into lobules by fibrous trabeculæ. Each lobule is composed of semitransparent whitish gelatinous tissue. The tumor has a markedly destructive effect on bone and may metastasize to regional lymphatics and rarely to liver.

Histologically the characteristic features of the neoplasm are its alveolar character, cytoplasmic and intracellular vacuolation, and intercellular collections of mucinous fluid. Clinically they preponderate in the male, are of slow growth, low-grade malignancy, infiltrative and destructive, and tend to recur locally. They may attain an enormous size, producing pressure on the rectum, the largest of record weighing 13 pounds.

Endotheliomata.—These rare tumors are similar to gliomata in origin and clinical characteristics.

Symptoms.—These depend primarily on the size, situation and direction of extension of the tumor which may remain quiescent for many years and then suddenly grow with great rapidity for some unexplained reason.

Owing to their superficial situation, postsacral and postcoccygeal tumors are usually recognized and treated early.

Tumors arising in the rectum proper usually produce symptoms of an obstructive nature and are diagnosticated comparatively early by digital palpation or proctoscopy. Those situated in the retrorectal, rectovaginal or pelvirectal spaces produce symptoms which may be initially referred to the rectum, as constipation, obstipation, sense of incomplete evacuation, dragging or heaviness in the pelvis, painful defecation and straining at stool. Hemorrhoids may develop and several cases have been reported in which a radical hemorrhoidectomy was performed before the tumor was diagnosticated. They may press on the ureters and produce renal symptoms. They have obstructed pregnancy and a gush of fluid from the vagina or rectum has been the initial symptom of a ruptured dermoid. At times they may remain symptomless and be inadvertently discovered on rectal or vaginal examinations.

Gliomata, chordomata and endotheliomata, and tumors arising from neural structures, owing to their early invasion of the cord tend to cause pain in the region of the sacrum or coccyx, or referred pain in the divisions of the sacral and lumbar plexuses, giving rise to sphincter disturbances and paresthesias in the perianal region or the urinary organs. These tumors are apt to masquerade under the diagnosis of sciatica, coccygodynia, arthritis, sacral neuralgia, etc.

Diagnosis.—The majority of sacrococcygeal tumors are present at birth and are fairly easy to diagnose. In the adult, however, the majority are situated in the pelvis and on account of their rarity, their unusual attachments, and atypical locations they at times offer considerable difficulty in the differential diagnosis. Tumors situated behind the sacrum, particularly in infancy, must be carefully differentiated from meningocele, myelocele, and syringomyelocele which are the most common conditions found in this region and which are commonly associated with a spina bifida. Tumors situated anterior to the sacrum and in the pelvis have been confounded with nearly every intrapelvic condition, as procidentia uteri, ovarian and intraligamentous cysts, extra-uterine pregnancy, fibroids, and even enlarged prostate.

Anterior meningocele, with or without an associated spina bifida, may occur alone or form part of a more or less complex tumor in the sacral region and this association is of the utmost importance. Although they are much more frequently associated with congenital tumors they may also be associated with benign, acquired neoplasms. This is exemplified in a case reported by Kennedy in which, following the removal of a rectal polyp, an infant of twenty-two months succumbed to meningitis. Necropsy revealed an anterior meningocele with a spina bifida occulta. Tumors situated at the side of the sacrum and even in the gluteal region have been reported with a similar connection.

Tumors arising in the sacral canal or from the cauda equina may grow to fairly large dimensions either anteriorly or posteriorly and their exact site of origin may be quite unsuspected. A possible connection with the dura, however,

should always be borne in mind. Such tumors are apt to be confounded with tuberculosis or arthritis of the spine, tabes, lower cord lesions, syringomyelia, sciatica, etc. Tumors encroaching on the rectal wall from without may be mistaken for ulceration or abscess and the differentiation of their intra- or extra-rectal location is of great importance from the surgical standpoint.

Roentgenograms are of value in revealing a spina bifida which, if present, should lead one to suspect an associated meningocele, or a connection with the



FIG. 318.—CAUDAL APPENDAGE. MALE FILIPINO.

Courtesy of L. J. Hirschman who photographed the subject in the Philippines and was told that several other members of the same native tribe had similar appendages. This is an example of true tail, containing cartilage and bone, as described on page 488.

dura; or it may reveal teeth, or other bony structures presenting unsuspected ramifications of the tumor, the extent of which may be far greater than is usually anticipated.

Treatment.—When feasible, complete surgical extirpation of the neoplasms is indicated. Piecemeal removal may have to be resorted to. Pedunculated tumors of the rectum may be removed by transfixion of the pedicle, by the actual cautery or by surgical endothermy. Tumors situated in the presacral region are best approached by the posterior route with removal of the coccyx and lower sacral vertebræ when necessary. The transperitoneal approach may prove a dangerous and difficult or impossible procedure.

In malignant tumors, radium and x-ray may be used after excision, with indefinite results.

In sarcomata, Coley's serum may be tried.

In the newborn, it is generally agreed that operative interference should be postponed until after the first year, if practicable.

The operative mortality in infancy varies around 40 per cent, the majority developing a meningitis or hydrocephalus. Infection is difficult to control on account of the proximity of the anus.

In childhood and adults the mortality is somewhat less, depending in great measure on the rapidity of growth, the malignancy, and the ease of surgical approach.

The *prognosis* is usually unfavorable, and in those associated with a meningocele it is practically hopeless.

CAUDAL APPENDAGES

These extremely rare vestigial structures are classified into true and false or pseudo tails. True tails contain cartilage and bone and are definite prolongations of the coccyx. Pseudo tails are attributed to a persistence of the caudal ligament or may be tail-like tumefactions, the most common of which are lipomata. Treatment is by excision and the results are good.

REFERENCES

- ALEXANDER, W. A., and STRUTHERS, J. W. "Sacrococcygeal Chordoma," *J. Path. & Bacteriol.*, 1926, 29: 61.
- BLAND-SUTTON, Sir J. *Tumors, Innocent and Malignant*, 7th Ed., New York, Hoeber, 1922.
- CALBET, J. *Contribution à l'étude des Tumeurs à l'origine parasitaire de la région sacrococcygienne*, Paris, G. Steinheil, 1893, p. 226.
- CLADO, S. *Traité des tumeurs de la vessie*, Paris, 1895.
- CLUTTON, *Tr. Path. Soc.*, Lond., 1886.
- DALAND, E. M. "Chordoma," *Brit. M. & S. J.*, 1919, 180: 571-576.
- ENGLEMAN. "Beiträge zur Kenntnis der Sacral Tumoren," *Arch. f. klin. Chir.*, Berl., 1903, 77: 368-382.
- HANSMANN, G. H. *Surg., Gynec. & Obst.*, Chicago, 1926, Vol. 42, No. 1.
- HUNDLING, H. W. "Ventral Tumors of Sacrum," *Surg. Gynec. & Obst.*, Chicago, 1924, p. 813.
- JARDINE. *Glasgow M. J.*, 1893.
- KEEN, W. W., and COPLIN, W. M. L. "Sacrococcygeal Tumors," *Surg., Gynec. & Obst.*, Chicago, 1906, 3: 661.
- KENNEDY, R. L. *J. Surg., Gynec. & Obst.*, Chicago, Dec., 1926.
- KIMPTON, A. R. "Glioma of the Buttocks," *Ann. Surg.*, Phila., Nov., 1919, p. 582.
- MALLORY, F. B. "Sacrococcygeal Dimples, Sinuses and Cysts," *Am. J. M. Sc.*, Phila., 1892, 103: 263.
- MARKOE, F., and SCHLEY, W. S. *Am. J. M. Sc.*, Phila., May, 1902.
- MIDDLEDORFF, K. "Zur Kenntnis die Angeborene Sacralgeschwülste," *Arch. f. Path. Anat.*, Berl., 1885, 101: 37.

- MOISE, T. S. "Staphylococcus Meningitis Secondary to a Congenital Sacral Sinus," *Surg., Gynec. & Obst.*, Chicago, March, 1926.
- ORD, W. M. *Med.-Chir. Tr.*, 1880, Vol. 63.
- PAGE, H. M. *Brit. M. J.*, Lond., Feb. 21, 1891.
- POST. *Tr. Path. Soc.*, Lond., 1880.
- RIBBERT, H. *Verhandl. d. Cong. f. innere Med.*, Wiesb., 1895, Vol. 13.
- SCHRAMM, H. "Zur Kenntniss der sogenannten Sakral Tumoren," *Wien. klin. Wchnschr.*, 1900, 23: 55-58.
- STEWART, M. J., and MORIN, J. E. "Chordoma, with Review of Reported Cases," *J. Path. & Bacteriol.*, Jan., 1926.

CHAPTER XXVIII

MALIGNANT TUMORS

GENERAL CONSIDERATIONS

During the past thirty years, professional and public interest in the subject of cancer has been keen and universal. City, state and privately endowed philanthropic institutions have been established to foster intensive study of malignant disease; to discover, if possible, the specific etiology; to disseminate scientific knowledge among physicians; to inform the laity of the early signs of malignancy; and finally to combat the dread malady by prophylaxis, and by the most reliable measures of therapy. The latter received a new impulse through the therapeutic application of two comparatively new agents: The x-ray, discovered by W. K. Roentgen of Munich, in 1895; and radium, discovered by Madame Marie S. Curie, a physicist of Paris, in 1898. When we realize that approximately one of every ten persons over forty years of age now living is doomed to die of cancer, it is easy to account for this general interest.

Incidence.—Current opinion is that the incidence of cancer is increasing. The twenty-fifth compilation of the United States Bureau of the Census, giving the mortality statistics for 1924, covers a registration area containing an estimated population of 99,200,298, or 88.5 per cent of the total. There were 1,173,990 deaths, corresponding to a death rate of 11.8 per thousand population. The crude death rate has declined gradually from 19.8 in 1880 to 11.8 for the year 1924. The death rate under five years declined from 30.7 in 1900 to 18.7 in 1924. On the other hand, the death rate for cancer and other malignant tumors in the registration states of 1900 shows the following significant increases:

<i>Year</i>	<i>Rate per 100,000 Population</i>
1900	64
1910	83
1915	92
1920	98.9
1924	109.8

In 1924, of the total 91,138 deaths due to "cancer and other malignant tumors," 51,273 (56.3 per cent) were females and 39,865 (43.4 per cent) males. Although the male population invariably exceeds the female, the high incidence of cancer of the breast and generative organs of women accounts for the preponderance in the latter.

Of the total 91,138 cancer deaths in 1924, the organs involved were:

Stomach and liver.....	34,250 (37.6 per cent)
Female genital organs.....	12,836 (14.0 per cent)
Mesentery and peritoneum.....	770 (0.8 per cent)
Intestines (except rectum).....	8,000 (8.8 per cent)
Rectum and anus.....	3,757 (4.1 per cent)

The number of cases and percentage in respective years for the last two groups were:

	1924	1923	1921	1920
Intestine (except rectum) .	8,000 (8.8 per cent)	7,616 (8.8 per cent)	6,834 (9 per cent)	6,238 (8.6 per cent)
Rectum and anus	3,757 (4.1 per cent)	3,501 (4.0 per cent)	3,029 (4 per cent)	2,816 (3.9 per cent)

In the city of New York, deaths from all forms of cancer have increased from 3,710 in 1910 to 7,033 in 1926, an increase of 55 per cent in the rate per hundred thousand population. For cancer of the intestines the deaths in the same period increased from 602 to 1,107, or 54 per cent per hundred thousand population. The records for New York City show that during the past fifty-nine years (1868-1926) the rate of all forms of cancer per one hundred thousand population has increased from 35 to 119, or 240 per cent. Expressed in other terms, where two persons died of cancer in 1868, almost seven persons died therefrom in 1926. It must be remembered that the cancer death rate of large cities is steadily growing by the influx of non-residents for treatment. Thus, in the city of New York, the increase of population from 1910 to 1926 was 24 per cent, but the increase in the number of deaths of non-residents from all forms of cancer for the same period was 185 per cent.

According to the statistics of the Metropolitan Life Insurance Company, "cancer of the peritoneum, intestines and rectum shows significant increases of death rate in all age groups in the total Industrial Department (about 17,000,000 policyholders), white males, white females, and in colored females at ages 25 and over and 45 and over."

In general, according to the United States Census, the rate of accessible cancer—skin, buccal cavity and breast—shows only a slight increase of rate from 1920 (14.5 per cent) to 1924 (14.9 per cent). On the other hand, the increase of incidence has been almost entirely in the age periods above thirty-five years and due largely to inaccessible growths.

Statistics on the incidence of cancer derived from various sources show wide variations. However, study of series of statistics seems to indicate that the incidence of external or accessible cancer has remained practically the same for some years, whereas the percentage of inaccessible cases recognized is increasing. The increased incidence in the internal group is readily explainable, in part at least, by (1) the more accurate filling in of death certificates; (2) im-

proved methods of diagnosis, especially the x-ray, endoscopic examinations, and diagnostic incision; and (3) chiefly, prolongation of the span of life from an expectancy of forty years in 1850 to forty-five years in 1875 and fifty-eight years in 1926, whereby large numbers now reach the "cancer age" who formerly would have died from diseases now preventable or controllable. Obviously the more people reaching the "cancer age," the greater is the incidence of cancer.

All statistics on cancer are subject to grave diagnostic error. This is naturally greater in non-institutional deaths. Thus, in a series of 3,712 necropsies by Wells from his own records and at the Cook County Hospital, there were 578 cases of malignant neoplasms. There were 211 incorrect diagnoses, or a diagnostic error of 36.5 per cent. During the years 1920 and 1921, in the German Empire autopsies were performed on 8,301 cancer cases. According to Lubarsch, the diagnostic error of the internal carcinomata of this group was 32.44 per cent. Series of records from other countries showed similar results.

Rate.—Cancer is a universal condition but some races show a greater susceptibility in certain organs. This is contrary to the opinion frequently expressed that uncivilized and primitive peoples enjoy comparative immunity from the disease.

Madden, professor of surgery at the government school of medicine at Cairo, writes: "Malignant disease among tropical and semi-tropical peoples, even in the black races, is much more common than is generally believed. With the Oriental and tropical precocity in development, malignant disease often appears at a very early age; epithelioma of the tongue for instance at the age of 10, and cancer of the breast at what may seem to us an absurdly early age."

Between the years 1907 and 1923, autopsies were performed in the morgue of the Philippine Medical School on 8,960 Filipinos. Vedder found the incidence of tumor as the cause of death in these cases to be: Carcinoma in 173, sarcoma in 60, and benign tumors in 132. Approximately 30 per cent of the carcinomata were in Filipinos under forty years of age. Vedder's comparison of statistics at different periods does not indicate that the incidence of cancer among Filipinos is increasing, but is approximately the same as that in the United States. Furthermore, the fact that the diet of the Filipino is chiefly vegetable, consisting largely of rice, tends to negative the assumption that dietary habits and the resulting nutritional conditions, particularly an excessive consumption of meat and sugar by Americans and certain Europeans, increases the susceptibility to cancer.

Sir Leonard Rogers, in his twenty years' experience as pathologist in Calcutta, examined microscopically 1,190 tumors, 57.9 per cent of which were malignant. This compares with a percentage of malignancy of 56.5 in one thousand tumors examined at St. Mary's Hospital, London. The expectation of life among primitive peoples is much shorter than in more civilized countries, *e.g.*, for males, in India, 26.6; in the United States, fifty-eight years. Consequently, a larger proportion of the malignant growths occurring in primitive people are sarcomata, but Rogers found cancer relatively as frequent in India as in England in those who lived beyond the fortieth year.

Several observers have noted the comparative immunity of the American negro to cancer of the rectum. Royster, in a review of all cases operated upon at St. Agnes Hospital (for colored patients) over a period of fifteen years, records no case of rectal cancer. Rosser, in a five-year period at Baylor Hospital, Texas, observed thirty-seven carcinomata of the rectum, only one of which was in a colored person. On the other hand, the author has seen at the clinic, rectal carcinoma in five colored patients, four females, one male, all proved by biopsy. There may be a racial difference in cancer susceptibility or merely a difference in susceptibility of different organs. For example, the tendency of the negro to develop fibrous tissue overgrowths probably bears on a direct relationship between the comparatively large number of rectal strictures in colored people and their relative freedom from rectal carcinomata.

Etiology.—Although the specific cause of cancer is as yet unknown, many theories have been advanced to explain the etiology.

Cohnheim's theory of embryonic cell rests does not explain cancer adequately, but to-day is more acceptable for the pathogenesis of certain benign growths.

Ribbert considered that a disturbance of the balance between the epithelium and connective tissue resulted in cancer.

Hansmann held that cancer is due to a loss in ability of the cells to differentiate. In general, the normal cells of the adult have limited power of proliferation but are differentiated and endowed with highly specialized functions. A cancer cell, on the other hand, loses its power of differentiation, and regains the power of proliferation, which normal cells possess only during fetal life.

Parasitic Hypothesis.—From time to time announcement has been made of the discovery of the cancer parasite. Gye is the most recent to report a specific bacterial etiology for cancer—either a bacterium which he has isolated, or a specific virus contained in the filtrate. The prevalent opinion is that the most probable rôle of a parasite in the etiology of cancer is in increasing through their activity the susceptibility to cancer of a group of normal cells, in other words, causing them to enter into the precancerous state.

Inoculation.—Human cancer is not communicable. One person cannot be inoculated from another. Transplantation of a graft from a primary tumor succeeds only in the same individual, but not in another. In certain species of lower animals, *e.g.*, white mice and rats, inoculation of normal animals with cancer cells is successful in the same species. Raus has described a spindle-cell sarcoma of the fowl which is not only inoculable in chickens, but can also be propagated in them by tumor filtrate, passed through a Berkefeld filter. This filter must remove the viable cancer cells. Consequently the sarcoma induced in chickens by the filtrate must be the result of a chemical agent or an ultra-microscopic microorganism.

Heredity.—Maud Slye has caused tumors to be transmitted through scores of generations of mice and by the application of the Mendelian laws of inheritance is able to predict which mice will develop neoplasms. The longer span of

life in man practically precludes such studies, although a few families have been observed carefully for several generations. It must be remembered that a single diagnostic error would invalidate the application of the Mendelian principles of heredity in a given family. Moreover, it is to be noted that experimentally controlled tumors in animals are in many respects analogous to but not identical with cancer in man. Again, it is well-nigh impossible to obtain a trustworthy history of cancer in several generations of the same family. Such family records have been made, but they are so few that coincidence would explain the relationship quite as well as heredity. Cancer, as such, is not directly inheritable, *i.e.*, transmitted directly from parents to their offspring. On the other hand, scientific evidence strongly supports the opinion of heredity of susceptibility and of resistance to cancer.

Irritation.—Chief among the factors immediately operative in a large percentage of cancer cases is long-continued irritation with or without individual susceptibility, which may be either inherited or acquired. Evidence of chronic irritation as the effective exciting factor in cancer is furnished by the frequent development of "Kangri cancer" in the abdominal skin of the natives of Kashmir due to the overheating from charcoal stoves; buccal cancer in Asiatics who chew betel nut with lime; cancer of the bladder and rectum in Egyptians, due to infestation and irritation by *Bilharzia hematobia*, forty cases of which Ferguson reported in 1911; cancer of the hands observed in paraffin workers; and cancer of the hands in roentgenologists.

Borrel, Fibiger and others induced cancers experimentally in lower animals by prolonged irritation with animal parasites; Tamaguna, Bang and others by long-continued irritation of a rabbit's ear with tar and coal-tar derivatives. Not all of the animals reacted by the formation of cancers, but in the cases where tumors resulted they were true malignancies and frequently metastasized.

A study of the etiology, morphology and clinical course of malignant neoplasms indicates that cancer is not a single disease but a term under which is grouped a number of pathological processes having in common the neoplastic manifestations of unrestrained growth of tissue cells, destruction of normal tissue, formation of metastases, cachexia and rather frequent recurrence after operative removal.

A cancer, then, is an autonomous new growth or tumor of glandular epithelium in atypical arrangement, induced by irritation, either mechanical, thermal, chemical or bacteriological; and in man may also develop on old chronic inflammatory processes, atrophic tissue and congenital defects and tumors, and frequently develops in benign growths.

Precancerous Conditions.—At present there is no means of determining individual susceptibility to cancer. Yet the clinician is constantly recognizing lesions and pathological conditions that frequently become the site of cancer. In the anorectal region these potentially malignant conditions may be grouped, as:

I. *Chronic Inflammatory Processes.*—Syphilis has an unusual capacity to ex-

cite neoplastic growth. Other lesions are : Fissures and ulcers, not dependent on a constitutional condition, situated within the bowel or especially at the mucocutaneous junction, and when subject to repeated trauma (hard stools, scratching, clothing) ; anorectal fistula ; patches of thickened perianal skin due to chronic eczema or pruritic dermatitis, and the engrafting of carcinoma on diverticulitis. In forty-two cases of diverticulitis of the colon, cancer coexisted in thirteen, and Mayo concluded that infection, irritation and trauma established the precancerous condition.

2. *Scar Tissue*.—Cancer may develop in cicatrices following operation or in organic strictures of the rectum. The author has observed three patients with carcinoma developing in postoperative scars. The first was a gentleman, aged sixty-five, operated upon by the writer twelve years previously for extensive posterior pelvirectal abscess and fistula. The neoplasm was 8 centimeters above the anus. The second patient was a lady aged fifty-three, who had been operated upon elsewhere eleven years before for a fistula with high rectal opening. A colloid carcinoma developed in the inner portion of the extensive scar tissue. The third patient, a gentleman aged fifty, developed an epidermoid carcinoma on the buttock in the outer end of the scar which followed the removal by the author of a tuberculous fistula, twelve months earlier, the wound of which had healed perfectly.

3. *Simple Tumors*.—Although it is exceptional for carcinoma to develop on hemorrhoids, it is easy to believe that ulcerated chronic internal piles present conditions favorable to neoplastic change. This, in fact, had occurred in two male patients admitted to the New York City Cancer Institute. Exner also records one case of hemorrhoids which underwent sarcomatous degeneration.

Congenital tumors and malformations rarely become malignant. On the other hand, certain simple tumors of the colon and rectum are very prone to malignant degeneration. This is especially true of adenomata and the shaggy villous type of papilloma. The writer has operated upon seven cases of solitary adenoma of the rectum and sigmoid, all of which histologically were adenocarcinoma. One case of multiple adenomata of the colon became carcinomatous and in Verse's fifty-seven cases of intestinal polyposis twenty-two were cancerous. The author is in accord with the view of Mummery and others that all cases of multiple adenomata of the colon and rectum are definitely a precancerous condition, all of them eventually degenerating into adenocarcinoma.

Dukes states that well-developed adenomata are found in the portion of bowel between the cecum and sigmoid in approximately 10 per cent (12 in 127 cases) of people dying from diseases other than cancer, whereas small tumors are almost invariably present in the mucosa around a cancer of the rectum or sigmoid. In thirty-three cases of cancer of the rectum removed at St. Mark's Hospital, London, Dukes found adenomata present in 25 or 75 per cent. He considers this percentage too low, as adenomata probably remained in the adjacent bowel which might explain recurrences in certain cases.

The experimental work of J. A. Murray on tar cancer in mice lends strong support to the belief that carcinoma of the bowel develops in a preceding adenoma. The skin of mice painted with tar develops multiple adenomata, one of which assumes a malignant character while the others do not progress. Mummery was so impressed by the close relationship between adenoma and carcinoma that he states, "I believe that the majority of carcinomata of the rectum start in the first place as simple adenomata."

CARCINOMA OF THE RECTUM AND SIGMOID

Occurrence.—According to statistics, carcinoma of the rectum or of the rectosigmoid comprises about 4 per cent of all cancers of the body. In the gastro-intestinal tract the stomach is involved most frequently, but approximately 80 per cent of all intestinal cancers are in the rectum or rectosigmoid. In the colon the frequency of occurrence increases from the ileocecal valve onward. At the Vienna General Hospital in the period of thirty-five years (1858-1893) necropsies were performed on 8,142 patients dying of carcinoma. Of these 305 (3.7 per cent) involved the rectum. In the series of 3,585 necropsies from 1870-1983 Nothnagel found the site of involvement to be: Small intestine, seventeen; appendix, two; cecum, twenty-three; colon, eighty-six; sigmoid, fifty-three; rectum, 162.

Age.—In 7,313 collected cases, Pennington recorded the age incidence as follows:

<i>Years</i>	
Under 20	40
21-30	235
31-40	690
41-50	1,462
51-60	2,120
61-70	1,836
71 plus	930

The age incidence by decades in the author's series of 320 cases of carcinoma of the rectum and sigmoid was:

<i>Years</i>	
10-19	1
20-29	13
30-39	38
40-49	64
50-59	103
60-69	74
70-79	23
80-89	4

The youngest patient was a youth, aged nineteen, with colloid carcinoma of the rectum.

LOCATION OF TUMOR IN AGE INCIDENCE (YEOMANS' SERIES, 320 CASES)

Age, Years	Anus, 29 Cases		Rectum, 249 Cases		Sigmoid, 42 Cases	
	M.	F.	M.	F.	M.	F.
Under 20	0	0	1	0	0	0
20 to 29	1	0	9	2	1	0
30 to 39	2	2	21	12	1	4
40 to 49	1	3	27	20	4	4
50 to 59	9	2	56	23	6	6
60 to 69	7	2	40	15	7	4
70 to 79	0	0	16	5	3	0
80 to 89	0	0	2	0	0	2
TOTALS	20	9	172	77	22	20

Clark collected from the literature, including one of his own, fifty-two cases of carcinoma of the rectum occurring in persons under twenty years of age. Included in these were three aged eleven years; five aged twelve years; two aged thirteen years; three aged fourteen years; four aged fifteen years, two aged sixteen years, and six aged seventeen years. However, the great majority of cases of rectal involvement are of the cancer age, *i.e.*, over forty years; and of the sigmoid about fifty years.

Sex.—The ratio of incidence in males to females is about two to one. In Kuttner's series of 1,021 patients, 62 per cent were males and 38 per cent females. Of our 320 patients, 214 were males and 106 females.

Site of Tumor.—It is difficult to summarize the relative frequency of involvement of different segments of the rectum, as statistics vary on this point.

In a collection of 1,828 specimens of rectal carcinoma, Pennington found 1,277 (70 per cent) in the ampulla, 322 (7.5 per cent) involved the rectosigmoid, and 229 (12.5 per cent) were in the anal canal. In eighty-seven cases radically operated by Tuttle, fifty-four were within the palpable area (5 inches), and thirty-three at a higher level. Mummery finds the rectosigmoid the most common site, next the ampulla, and least frequently, the anus.

Buie classified the 1,020 cases operated upon at the Mayo Clinic: 587 were in the rectum, 265 in the rectosigmoid, and 168 in the sigmoid. The site in our series of 320 cases was anorectal, 29; rectal, 212; rectosigmoidal, 37; sigmoidal, 42.

The pelvic colon, after the rectum, is the most common site of intestinal carcinoma. In Kauffman's series of 123 intestinal carcinomata, thirty-six were in the colon, twenty-eight were in the sigmoid, and fifty-one in the rectum. The combined figures of Anschutz, Körte and Peterman comprise 297 cases of carcinomata of the colon, 124 of which were in the sigmoid. In the series of Tuttle, Clogg, Lichtenstein and the London Hospital there were 1,006 carcinomata of the colon proper, 364 or over one-third of which were in the sig-

moid flexure. The most common points of involvement were the apex of the sigmoid and the pelvirectal juncture.

Position of Tumor.—Regarding the position of the non-annular type in the rectal wall, 926 were anterior, 280 posterior, and only 99 lateral (Pennington). In 110 personal cases in which the position was accurately noted, the tumor involved the anterior rectal wall in thirty-nine, the posterior wall in thirty-three, the lateral wall in seven, and was annular in thirty-one. In general, it may be stated that about 90 per cent of rectal carcinomata are palpable, so that in only 10 per cent is the

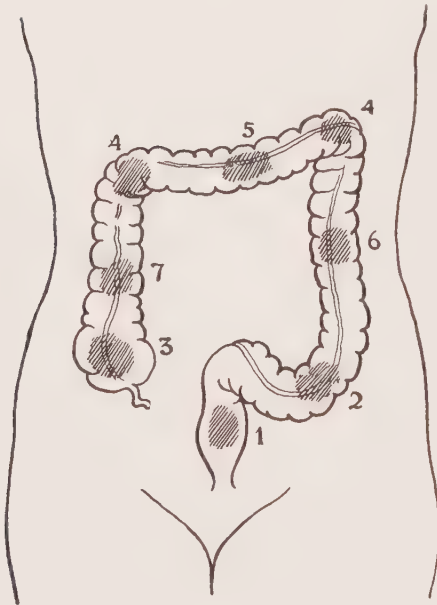


FIG. 319.—INCIDENCE OF CARCINOMA IN LARGE BOWEL.

Numbered in order of frequency: (1) Rectum; (2) sigmoid; (3) cecum; (4) hepatic and splenic flexures; (5) transverse colon; (6) descending colon; (7) ascending colon.

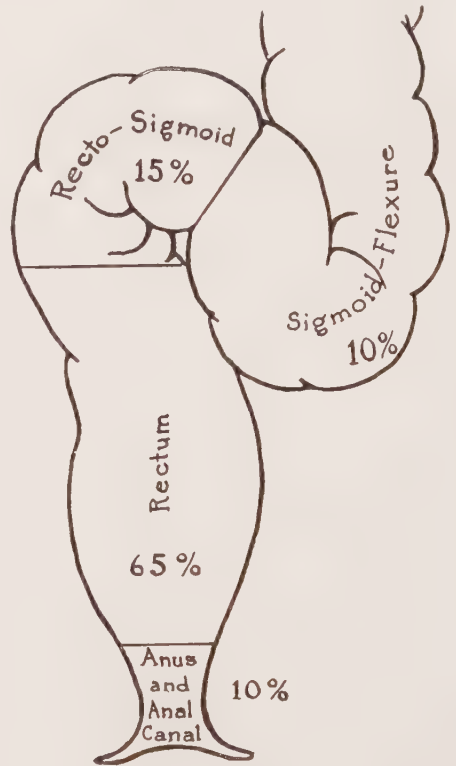


FIG. 320.—PERCENTAGE INCIDENCE OF CARCINOMA IN ANAL CANAL, RECTUM AND SIGMOID FLEXURE.

proctoscope essential to determine the presence of a growth at a higher level. Also, that the anterior rectal wall is more frequently involved than are the other walls. The segment of bowel invaded varies from 5 to 10 centimeters in length.

Pathology.—Histologically and corresponding with their origin, the chief primary malignant tumors of the sigmoid and rectum are cylindrical cell carcinomata; and of the anus, epitheliomata.

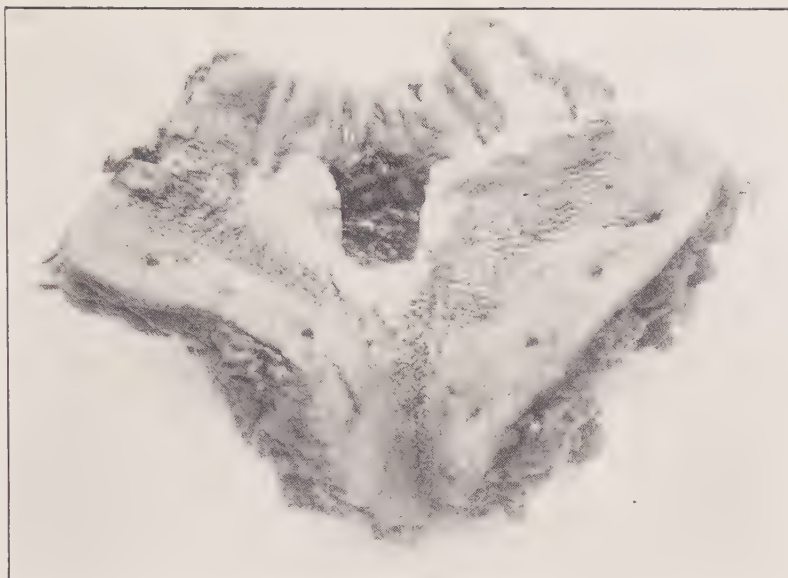


FIG. 321.—EPITHELIOMA OF ANUS.

Female, aged thirty-three. Perineal excision of rectum. Longitudinal incision through anterior rectal wall of specimen, exposing the epithelioma (dark area) in posterior commissure.

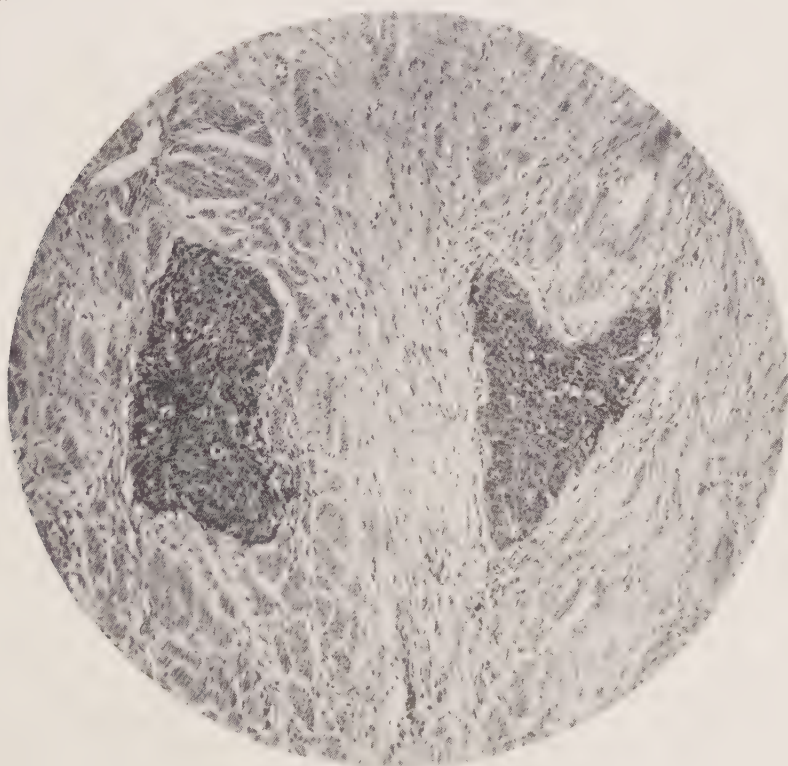


FIG. 322.—PHOTOMICROGRAPH OF EPITHELIOMA OF ANUS.

Epitheliomata (epidermoid carcinoma) are relatively rare and occur in the perianal skin or mucocutaneous lining of the anal canal. They may develop at the mouth of an old fistula or in a postoperative scar. The growth tends to encircle the anal canal early, to infiltrate beyond the anal margin, and involve the inguinal lymph-nodes early. The firm mass has an indurated cartilaginous-like border and usually has a clean ulceration on its surface. Histologically the

great majority of anorectal epitheliomata are of the squamous cell type and, because of their malignancy, in the past gave a bad prognosis. Fortunately, the prospect is now much better with the aid of irradiation therapy.

Exceptionally an epithelioma is found in a higher segment of the rectum, arising from displaced cells, notably in a postoperative scar. One such personal case, in a man aged sixty-five, has been mentioned under "precancerous conditions."

Adenocarcinoma is practically the only type of carcinoma occurring in the rectum and sigmoid. On the basis of their different physical characters and variation in histological appearance, Peterson and Colmers and several other investigators have attempted to classify these tumors. However, they all have a common origin from the cylindrical epithelium lining

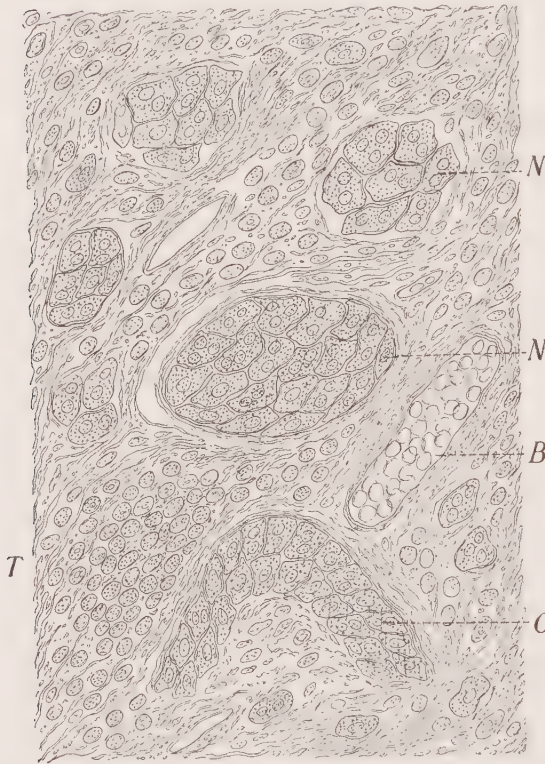


FIG. 323.—MEDULLARY CARCINOMA (MAGNIFIED 400 DIAMETERS).

NN, nests of cancer epithelia; G, remnant of gland; T, connective tissue infiltrated with round cells; B, blood-vessel.

the mucosal glands. The variation in form and modification of histologic structure is largely a result of rapidity of growth and secondary degenerative changes in the tumors. Thus, in addition to the transitional forms, there are the adenoid, which comprises the great majority of rectal cancers; the colloid or gelatinous, and the fibrous or scirrhus carcinomata.

This clinical division into three varieties rests on the physical characteristics of the tumors and their degree of malignancy. The figures of Peterson and Colmers, Du Pan, and others, show that of 1,155 specimens, 1,038 were of the

cylindrical-cell variety, forty-one scirrhus, twenty-two mixed, fourteen colloid; the forty remaining being epitheliomata of the anus.

The soft gelatinous or *colloid* tumors are rapidly growing, degenerated adenocarcinomata and are highly malignant.

In the *scirrhus* variety, the host, in response to the invasion of the adenocarcinoma, has thrown about the cancer cells an excessive amount of fibrous tissue which retards the growth, and suggests the possibility of a spontaneous cure.

Adenocarcinomata of the sigmoid and rectum arise from the secretory epithelium of the Lieberkühn glands situated in the mucosa. The cells in a definite

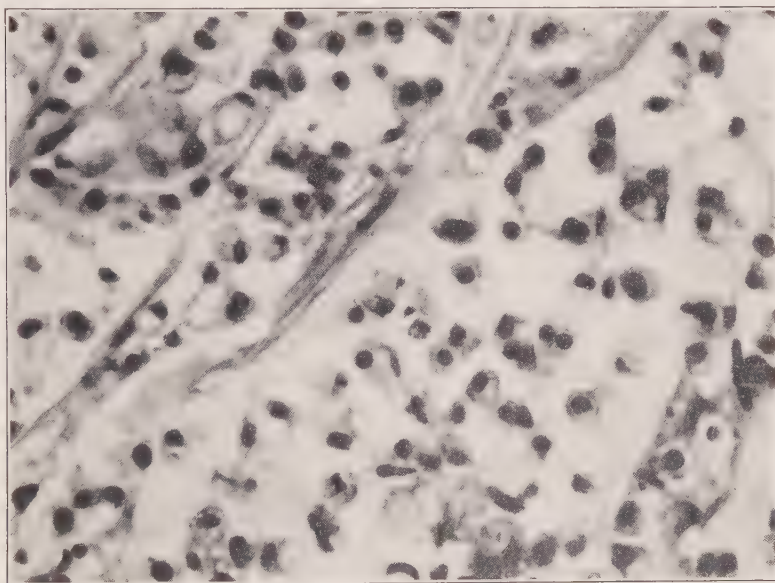


FIG. 324.—PHOTOMICROGRAPH OF COLLOID CARCINOMA OF ANUS AND RECTUM.
Male, aged forty-seven years.

area undergo rapid multiplication and by breaking through the muscularis mucosæ assume a neoplastic character. The sessile nodule involves the mucosa and submucosa and at first is freely movable upon the muscularis, but in a few months involves and adheres to the muscle. While the tumor is growing in all directions its surface usually becomes flattened and ulcerates early. As the tumor infiltrates around the circumference of its bowel, the ulcer becomes deeper and exhibits its definite characteristics, namely, a firm base with an everted, nodular, indurated margin.

Thrombosis of the sparse and fragile blood-vessels, trauma and infection, commonly lead to extensive ulceration, with consequent hemorrhage and sanious discharge.

Following the course of the lymphatics and blood-vessels, the cancer tends to encircle the gut, producing stenosis and symptoms of obstruction. Thus there results a greater area of involvement in the circumference than in the longitudinal axis of the gut.

Occasionally, in the final stages, especially in the annular stenosing form, abscess, perforation and fistula formation may occur.

The tumor involves the anterior rectal wall slightly more frequently than posterior, the lateral wall alone less often, and in about 30 per cent of cases it is annular.



FIG. 325.—SCIRRHOUS CARCINOMA OF INTESTINE (MAGNIFIED 350 DIAMETERS).

CT, dense, fibrous connective tissue; A, alveoli filled with cancer epithelia; C, cluster of rounded cells; E, row of cancer epithelia; B, blood-vessels.

Modes of Spread.—Cancer of the rectum and pelvic colon extends (a) by direct continuity of tissue. (b) through the blood stream, and (c) through the lymphatics. Spread by continuity is comparatively slow. It infiltrates over a slightly broader area in the deeper coats of the bowel wall than in the mucosa.

Peripheral extension in the mucosa is followed in a few months by invasion of the muscularis. The malignant process then extends through the perirectal fat to the fascia propria recti, which usually limits the spread temporarily. Absence of this fascia in the pelvic colon permits the cancer cells in this situation to more readily penetrate its wall to the peritoneum, bladder, uterus, ovaries and intestines.

According to the observations of Miles, the fascia propria is not

usually invaded until about three-fourths of the ampullary circumference is involved in the growth, *i.e.*, about one year after the initial objective symptoms, and approximately eighteen months from the beginning of the growth. After penetration of the fascia propria recti, the local growth ends with invasion of the pelvic connective tissues and adjacent organs. Colwell and DuPan noted in 146 cases spread by continuity to sacrum in forty-six, to bladder in sixteen, to prostate in nine, to uterus in five, and to seminal vesicles in three. In our series extension occurred to the prostate in one case, to the bladder in seven, and to the sacrum and coccyx in one. The vagina is involved more fre-

quently than the prostate. The prostatic aponeurosis is a strong barrier to invasion of prostate, seminal vesicles and bladder.

Spread through the lymphatic system is the most important path of dissemination of cancer cells. This system consists of an intramural network which communicates through the fascia propria with the extramural lymphatics and the regional anorectal glands of Gerota, which are distributed over the surface of the rectum along the branches of the superior hemorrhoidal vessels. Efferents from the involved extramural lymphatics and anorectal glands may convey cancer cells upward, downward or laterally; or simultaneously in two, and rarely in all three directions.

Arrest of cancer cells at any point during their transit through the lymphatics results in the formation of metastatic deposits, either macroscopic or microscopic.

The most constant and consequently the most important direction of spread is upward. The structures in this zone liable to permeation are the retrorectal glands, entire pelvic mesocolon, the paracolic glands, the glands at the bifurcation of the left common iliac artery, and the median lumbar or aortic glands. Occasionally even the group of glands around the celiac axis are involved. Clinical experience has unfortunately shown that in several instances metastasis has occurred to distant glands while the primary tumor is still in an early stage of development.

Spread through the blood stream is the least frequent mode of dissemination and usually does not occur until the malignant process is well advanced. The venous radicals in the rectum are an integral part of the portal system. After invading the venous radicals, cancer cells may be set free in the blood stream and carried as tumor-cell emboli from a rectal carcinoma to the liver, the most common site of metastasis. Clinically the hepatic involvement may dominate the picture.

Metastases.—Buday, Riechelmann, and others, found in 1,112 necropsies metastases to the regional nodes in 336 cases (30 per cent), and to distant nodes in sixty cases (5.4 per cent). Distant metastases in the same group were:

Liver	245	Thyroid	8
Lungs	94	Spleen	6
Peritoneum	52	Skin	6
Pancreas	16	Heart	5
Bones	15	Pericardium	4
Suprarenal gland	13	Bladder	3
Kidney	13	Uterus	2
Ovary	13	Breast	2
Intestine	13	Thoracic duct	2
Mesentery	10	Muscles	1
Stomach	10	Scrotum	1
Brain	9	Vagina	1

Metastases were present in 74 or 30 per cent of our 320 cases, as follows:

Liver	19	Axillary lymph-nodes ..	2
Liver and peritoneum..	1	Peritoneum	8
Liver and inguinal glands	5	Bladder	7
Liver, inguinals and peri-		Sacrum and coccyx.....	1
toneum	3	Sternum	1
Liver and prostate	1	Femur	1
Inguinal lymph-nodes ..	25		

Although its growth is more rapid and anaplasia increased, the metastatic deposit preserves the structural type of the primary growth to a remarkable degree. Bland-Sutton cites Pitt's patient whose arm was amputated for "periosteal sarcoma" of the humerus. Microscopic study of the tumor showed spaces lined with tall columnar epithelium as in Lieberkühn glands. Later examination of the patient revealed a carcinoma of the rectum.

Carcinoma of the sigmoid presents the same general characteristics as rectal carcinoma. In form the sigmoid tumor may be protuberant but more commonly is annular and stenosing, especially when it involves the rectosigmoidal juncture.

Constriction of the lumen by the growth results in hypertrophy of the colon above, and distention which parallels the degree of stenosis.

Due to its sparse lymphatic supply, metastases from the sigmoid are later and less frequent than when the primary growth is in the rectum.

Symmers reported the autopsy findings in 298 patients dying of malignant disease in Bellevue Hospital, New York, in the decade 1907-1917. Of the total, 220, or 74 per cent, had metastasized, but of the twenty-eight involving colon and rectum, only thirteen, or 46.5 per cent, showed secondary growths. These included seven rectal carcinomata with metastases in five, and six sigmoidal with no metastases. The regional lymph-nodes are the most common site of metastasis from a sigmoidal carcinoma. In fifty-two cases noted by Reichelmann and Colwell-Woodman, the regional lymph-nodes were involved in twenty-one, the liver in thirteen, lungs in five, small intestine in four, kidney and omentum, each two; the colon, stomach, pancreas, spleen, and the peritoneum, each one.

The preceding paragraphs on "spread" and "metastases" depict a gloomy prospect for victims of cancer of the sigmoid and rectum. It is true that in young persons the cancer is usually very malignant and dissemination rapid. However, the reader should remember that, although metastases to the regional lymph-nodes and distant organs may occur while the primary growth is still in an early stage of development, the reverse is the general rule in persons of the "cancer age." In comparison with malignancy in other situations, carcinoma of the rectum and sigmoid proper, until well advanced, metastasizes late and relatively rarely to distant organs. Spread is much earlier in rectosigmoidal involve-

ment. Moreover, the most common route of metastasis is the lymphatic system, but fortunately a majority of the lymph-nodes found enlarged are not carcinomatous but inflammatory, due to septic infection, through the primary cancerous focus. These are potent arguments for radical excision of operable carcinomata of these organs before the likelihood of metastases.

Secondary metastatic or implantation tumors of the rectum, although rare, are of great importance in the differential diagnosis. Metastases from distant

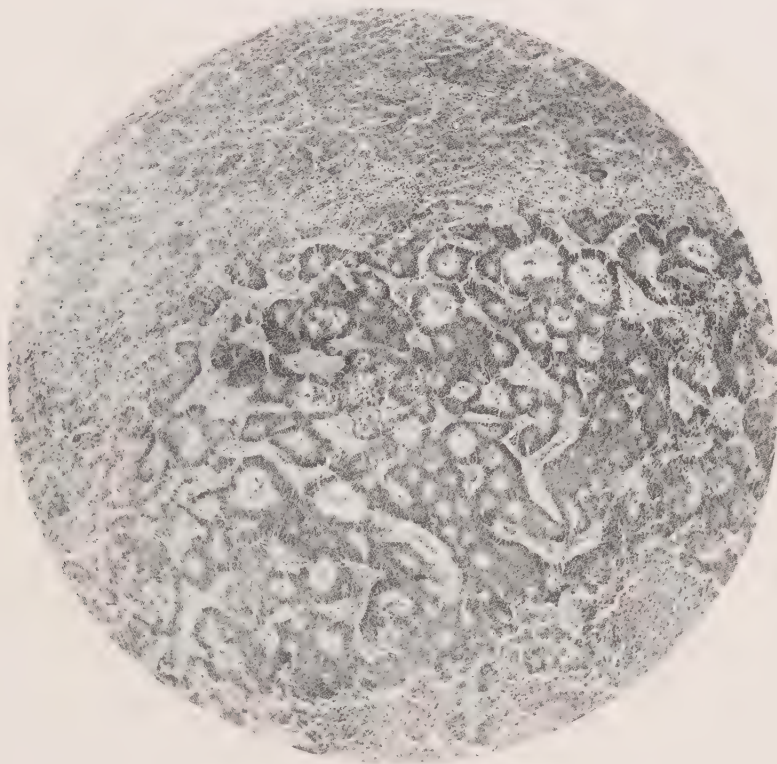


FIG. 326.—PHOTOMICROGRAPH OF ADENOCARCINOMA OF LIVER METASTATIC FROM CARCINOMA OF RECTUM ONE YEAR AFTER PERINEAL EXCISION.

Male, aged fifty-three years.

organs have been reported, where the primary growth in the trachea, mammary gland, or other organ remained in the background. Direct invasion of the rectum by cancers of the genital and urinary tracts is possible, but exceptional.

The most usual site of metastasis is Douglas' pouch. The early idea was that cancer cells, detached from a tumor at a higher level in the abdomen (stomach, colon), gravitated to the most dependent portion of the peritoneal cavity and engrafted themselves upon the peritoneum. However, the present belief of Blumer and others is that the culdesac metastasis is through the lymphatics. The metastatic malignant focus infiltrates the rectum in a circular manner, obstruct-

ing its lumen, and finally breaks into the bowel. According to Feldner, metastasis to Douglas' pouch occurs in 20 per cent of gastric carcinomata and in 18 per cent of gall-bladder carcinomata.

MULTIPLE PRIMARY CARCINOMA.—The rare simultaneous occurrence of two or more cancers in the bowel separated by stretches of normal mucosa is a clinical and operative pitfall. Littlewood had two cases: A woman of fifty-two having a cancer in splenic flexure and another in the rectum; the other, a man aged sixty-nine, tumor in ascending colon and rectum. Mummery's two examples were a man, aged thirty-five, tumor in rectum and descending colon; another man, growth in rectum and transverse colon.

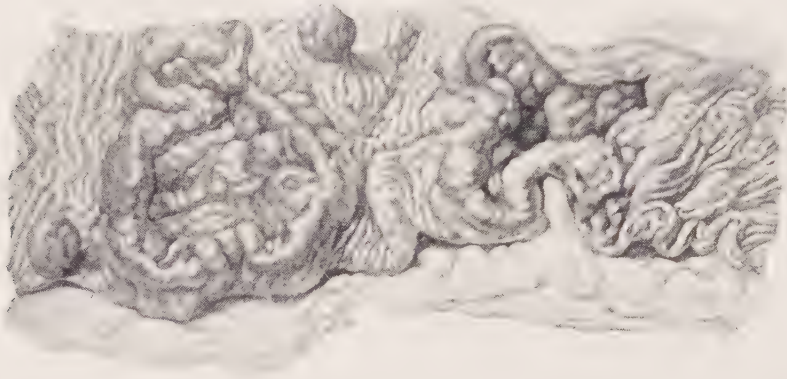


FIG. 327.—DOUBLE PRIMARY CARCINOMA OF THE RECTUM, PROBABLY FROM DEGENERATED ADENOMATA.

Note two adenomata also present.

A very probable method of formation of multiple cancerous foci in the intestine is that each cancer developed independently from a distinct and sequestered adenoma.

Handley has observed in some specimens cancer cells in the gut wall considerably *above* the tumor. Their heterogeneous development would result in secondary growths at a higher level. It must be remembered, however, that as a rule, the cancerous process is limited to the margin of the growth for a considerable time.

A third suggested method of secondary tumor formation is the implantation of cancer cells, detached from a growth at a higher point, into an abrasion or breach at a *lower* level. The importance of ascertaining, if possible, whether more than one neoplasm is present in the gut before beginning treatment is obvious.

Symptoms.—Hope of permanent relief in carcinoma of the rectum and pelvic colon, as in malignant tumors situated elsewhere, rests in early diagnosis and early treatment. External growths manifest themselves promptly to the patient, but in internal cancers there is at first, as a rule, no tumor or local change visible to the patient, and the early symptoms are vague. This is par-

ticularly true of neoplasms of the large bowel. We may correctly speak of the "silent" rectum as regards early pronounced symptoms. This concealment of symptoms is due in part to the large caliber of the affected bowel but mainly to the insidious nature of the disease which may produce only minor disturbances or remain almost symptomless for many months, eventually to force the patient to consult the physician for symptoms of marked ulceration or obstruction.

Duration of Symptoms.—A review of large series of cases shows that the average period of elapsed time from the earliest symptoms to the definite diagnosis is from six to ten months. In our series the period was six months for males and 7.8 months for females. This delay is due to two circumstances. Of these, one is quite beyond control, as the symptoms are frequently so obscure, gradual in their onset and cause so little disturbance that the patient does not seek medical advice early. The other important factor refers to the physician who all too frequently neglects thorough examination of the bowel or does not interpret his physical findings correctly.

A complete *history* is important and quite typical in advanced cases. In other cases it is misleading, the patient emphasizing the gastric or other symptoms.

Beginning carcinoma of the rectum and pelvic colon is symptomless or gives vague and indefinite symptoms referable to disturbed bowel function. An attack of obstinate constipation in a person of cancer age whose bowel action is usually normal; urgent desire to defecate in the morning on rising, with no result or only the passage of flatus and a little mucus, probably blood streaked; or abnormal rectal discharge and a vague ill-defined feeling that something is radically wrong in the lower abdomen; or a feeling of obstruction in the rectum, occurring separately or in combination, form a symptom-complex that is present in nearly every case of beginning carcinoma of the sigmoid or rectum. Indigestion, often accompanied by nausea, is a frequently associated early symptom.

Initial Symptoms.—Careful inquiry in our series of 320 cases elicited the table of first symptoms given on the following page.

This accords with the findings of other authors that the earliest symptoms are constipation, bleeding and pain.

In the *second stage*, when ulceration and secondary infection have developed, frequent foul discharges of mucus, blood and pus occur, constituting the so-called "cancer diarrhea," which is spurious, for the patient, as a rule, is still really constipated. Finally, the symptoms of intestinal obstruction may supervene. Anemia, emaciation and weakness are not characteristic of the first stage but are progressive in the second and third stages, but the anemia is usually of a lesser degree than when the proximal colon is the site of the tumor. Alvarez *et alii* have recently shown that carcinomata of the proximal half of the colon tend to produce very severe grades of anemia. This tendency progressively diminishes with cancers in the transverse, descending and pelvic portions of the colon.

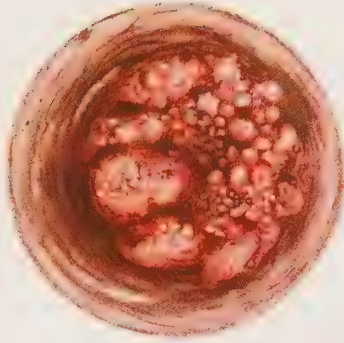
<i>Symptoms</i>	<i>Cases</i>
Constipation	104
Constipation and pain	29
Constipation and bleeding	13
Diarrhea	10
Diarrhea and pain	19
Diarrhea and bleeding	19
Bleeding	70
Bleeding and pain	25
Bleeding and protrusion	1
Vaginal bleeding	1
Hematuria	1
Pain in back	5
Pain in abdomen	13
Pain in anus	6
Nausea and vomiting	1
Dysuria	1
Fullness in rectum	1
Swelling in buttocks	1
TOTAL	320

Weight loss averaged 18 pounds in a personal series of 110 patients. One patient had lost 60 pounds, but several patients had not lost any weight, although the disease evidently had existed for several months.

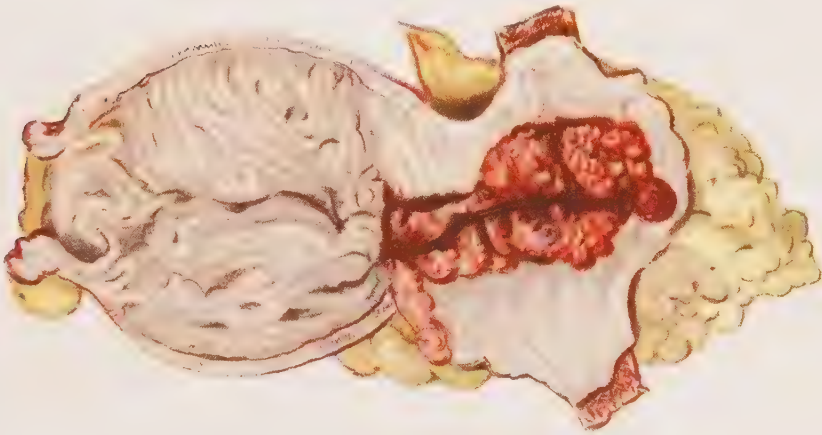
The *cachexia*, so characteristic of late cancer, is due chiefly to the toxic action of products absorbed from degenerating and ulcerating areas and bacterial infection. Hemorrhage, mechanical interference with digestion and pain are other important factors in cachexia.

Pain.—Exquisite pain is a cardinal symptom of epithelioma of the anus, but in general, pain is not pronounced in rectal carcinoma as usually situated unless the growth is very low, or until it has extended widely, involving the sacral and pelvic nerves, or has caused marked obstruction. Frequently, however, there is a feeling of fullness in the pelvis, of pressure and obstruction in the rectum, and often colic at stool. The onset is usually gradual, but may be abrupt, with sudden hemorrhage or symptoms of obstruction.

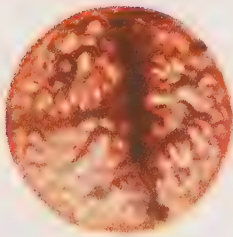
Symptomatology in Relation to Anatomic Location of the Tumor.—I. THE ANAL CANAL.—This is the segment least frequently involved. The growth originating here is an epithelioma which comprises approximately 10 per cent or less of rectal cancers. In a small percentage of cases an adenocarcinoma of the lower rectum encroaches upon the anal canal and very rarely internal hemorrhoids undergo malignant degeneration. The essential symptoms of anal canal involvement are torturing pain, slight bleeding and constipation—later incontinence.



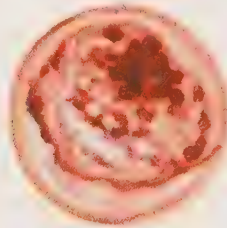
PROCTOSCOPIC APPEARANCE OF MEDULLARY CARCINOMA



CARCINOMA OF SIGMOID



CARCINOMA
OF SIGMOID
(PROCTOSCOPIC)



CARCINOMA
WITH ULCERATION
(PROCTOSCOPIC)

MALIGNANT NEOPLASMS.

2. **THE RECTAL AMPULLA.**—The most common site of neoplastic invasion, about two-thirds of all cancers of the terminal gut occur here, mostly adeno- and medullary carcinomata. They tend to extend radially but seldom reach the rectosigmoidal angle above, or the anal canal below. Because of the large lumen of the ampulla early symptoms are slight. Constipation is usually first noted, accompanied by slight bleeding, due in part to fecal traumatism of the fixed growth. After the neoplasm is well developed spurious “cancer diarrhea” and a feeling of weight in the pelvis supervene although constipation persists.

3. **THE RECTOSIGMOIDAL JUNCTURE.**—After the ampulla, this is the most common site of incidence and is involved in one-fourth or more of the cases. Moreover, in some cases, it is encroached upon by a neoplasm primary in the pelvic colon or rectal ampulla. The peritoneal reflection is encountered in this situation; the tumor tends to become annular, and is frequently scirrhus in type with the predominating symptoms of stenosis. Constipation, flatulence, colicky pain in the lower abdomen and mucus in the stools are early manifestations; later the empty rectum is distended with gas while the descending colon and sigmoid are filled with scybala.

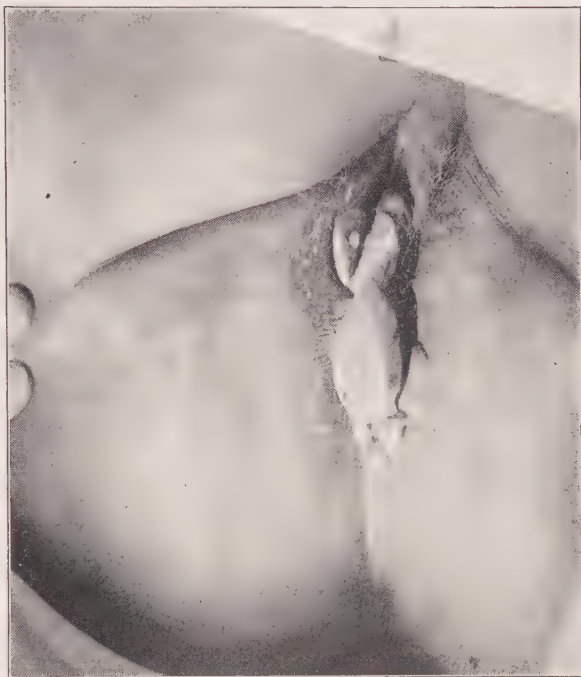


FIG. 328.—EPITHELIOMA OF ANUS AND VAGINA.
Patient aged sixty-four years.

4. **TOTAL OR GENERALIZED RECTAL CANCER.**—This occurs in about 1 per cent of cases (Quénu). It is characterized by symptoms of stenosis, ending in complete obstruction; by infection, and by abscess and fistulæ both on the skin surface and into adjacent organs.

5. **PELVIC COLON.**—Cancers in this situation usually grow slowly and tend to circular infiltration of the bowel wall with constriction of its lumen, indicated on its peritoneal surface by a cicatricial (scarlike) depression. When the growth is low in the pelvic colon, the symptoms are practically identical with those already given for rectosigmoidal involvement. The symptoms of tumors at higher levels are not characteristic but early are usually those of bowel irritation, and later of obstruction. Constipation, flatulence, abdominal distention and colicky

pains, with alternating attacks of diarrhea and the passage of considerable mucus may gradually pass over to pronounced stenosis. The patient experiences a feeling of discomfort in the lower left abdomen and across the loins. In other cases, with few or only minor symptoms, the bowel is suddenly and completely obstructed. Cathartics aggravate and enemas do not relieve the distress in the bowel which, proximal to the stenosis, is distended with gas and feces. Elderly patients, particularly the constipated, frequently remain in this obstructed state for several days before the true nature of the condition is recognized or consent given for surgical intervention.

Diagnosis.—The symptoms enumerated are not characteristic of carcinoma alone. They also occur in all other ulcerations of the terminal bowel, with simple tumors, stricture and other lesions. For this reason the patient presenting the above symptoms, in either a mild or pronounced form, must receive the benefit of a thorough examination.

Carcinoma of the rectum and lower sigmoid can now be diagnosed promptly and positively.

Failure of diagnosis is due to:

1. Omission of the rectal examination altogether.
2. Incomplete examination, (a) halting the investigation when piles, fissure or other coexisting pathology is found. A positive finding may not always be a complete diagnosis. A polyp may be found in the ampulla, higher, a cancer. (b) Failure to do a proctoscopy when the tumor is beyond reach of digital palpation.
3. Misinterpretation of things felt and seen.

In brief, early recognition of cancer of the rectum or pelvic colon is due not so much to a lack of knowledge as to failure to apply, at the earliest moment, the knowledge we possess.

The *physical examination* is both general and local. If the patient gives a history of marked obstipation and "cancer diarrhea," is emaciated weak and anemic he is probably already in the stage of terminal pathology, beyond any therapy. Jaundice, ascites and a visceral tumor, especially of the liver, indicate hopeless metastasis.

Abdominal Examination.—The sigmoid colon is often more prominent than normal and may be spastic above a stenosis. Unless unusually large, a tumor in the pelvic colon is seldom palpable. The masses frequently felt in the left lower quadrant and higher on the left side of the abdomen usually prove to be scybala. If the inguinal glands, which receive the lymphatic drainage below the anorectal line, are involved recurrence is prone to follow operation.

Local Examination.—**PALPATION.**—In women a *vaginal examination* should precede the rectal to determine the position and state of the uterus and its adnexa; the condition of the anterior rectal wall, and to reveal pathology in Douglas' pouch.

As a rule, *digital examination* of the rectum is made with the patient in the

lateral position. Sometimes a growth not otherwise palpable may be felt with the patient in a squatting posture; or under general anesthesia, by making counterpressure on the abdomen. The fact that approximately 90 per cent of rectal cancers can be felt by the index finger proves that palpation is the best single method of diagnosing this condition. Further, palpation determines the exact position of the tumor, its extent and physical character, and, above all, its degree of infiltration of the bowel wall and fixity to adjacent organs and structures.

Anterior fixation suggests implication of the prostate, seminal vesicles or bladder. *Cystoscopy* is indicated to disclose the condition of the bladder in cases of anterior involvement.

Clinically the growth proper may be:

(a) Protuberant or polypoid, intraluminal in growth; of small or large size, superficially ulcerated, and movable with the rectal mucosa. This type is relatively benign in that few or no lymph-nodes are involved.

(b) A craterlike excavated growth with indurated base and nodular margins, infiltrating the musculature and permeating the lymphatics early.

(c) An annular constricting growth with nodular or superficially ulcerated surface, occurring especially at the rectosigmoidal juncture, rather definitely limited to the bowel wall and tending to produce early stenosis.

These details of size, form, position, mobility or fixity, and ulceration of the tumor, its involvement of adjacent organs and metastasis, are all prime factors in determining operability and prognosis.

INSTRUMENTAL EXAMINATION.—For tumors beyond reach of palpations, the modern pneumo-electric proctoscope becomes an elongated finger with a human eye. For its successful use the bowel must be emptied by giving a large dose of castor oil the day previous. By this instrument of precision, the examiner can readily inspect the entire rectum and anal canal and in approximately 75 per cent of cases the sigmoid colon to its apex, a total distance of 30 to 35



FIG. 329.—RADIOGRAM SHOWING DEFECT OF RECTUM DUE TO A LARGE CARCINOMA.

Successful perineal excision. Male aged sixty-eight years.

centimeters. The graduated tube of $\frac{1}{2}$ inch caliber can usually be passed through a stricture or beyond a tumor to the normal mucosa above, thus determining precisely the length of the process. This examination reveals the form, size, ulceration and appearance of the tumor. It should be noted that proctoscopy is supplemental to and not a substitute for the digital palpation. Proctoscopy should not be omitted if a digital is done, and vice versa.

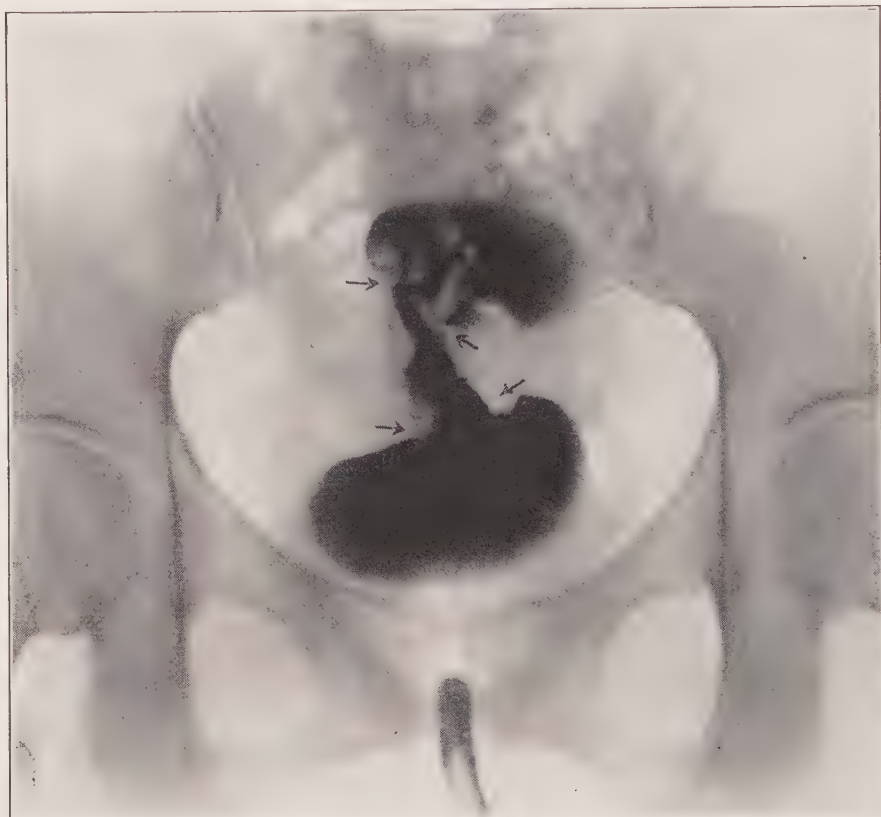


FIG. 330.—RADIOGRAM: ARROWS INDICATE LARGE DEFECT DUE TO ADENOCARCINOMA INVOLVING RECTOSIGMOIDAL JUNCTURE.
Male, aged fifty-seven.

Roentgen Ray.—When the symptoms indicate pathology of the terminal bowel, patients are frequently referred for x-ray examination without previous palpation of the rectum or proctoscopy. This is complicating diagnosis by substituting, in an accessible field, an indirect laboratory method for direct inspection and palpation. For the diagnosis of tumors of the rectum and lower sigmoid, roentgenograms are not only unnecessary but may be misleading as the growth is frequently missed. Palpation and proctosigmoidoscopy with a biopsy in certain doubtful cases, furnish all the precise data required. For growths above the

apex of the pelvic colon, the x-ray is very valuable. Moreover, in all cases of tumor, stricture or indurated ulcer of the bowel without urgent symptoms, roentgenograms should be obtained to detect, if possible, similar or other lesions sometimes present beyond reach of the tube. Carmen states that 75 per cent of colonic tumors can be detected by the x-ray.

Differential Diagnosis.—A. *From Other Anorectal Lesions.*—ANAL CANAL.—At its onset *epithelioma of the anus* closely simulates a painful callous



FIG. 331.—RADIOGRAM OF CARCINOMA OF PELVIC COLON.
Arrows indicate the defect. Male, aged forty-six.

anal fissure in both symptomatology and appearance. Bidigital examination, however, detects the deep hard induration characteristic of malignancy. *Chancres of the anus* superficially resembles ulcerated epithelioma, but the history and isolation of the *Spirochæta pallida* under the dark field distinguish it.

RECTUM PROPER.—*Thrombosed internal hemorrhoids* especially when ulcerated, may suggest malignancy. The swelling, however, is elastic and not indurated as is cancer.

In men with sclerosed vessels, the rectal veins may become thrombosed, rupture and bleed freely, and to palpation suggest a neoplasm. Proctoscopy is our surest means of recognizing them.

Inflammatory strictures are ulcerated and mimic the malignant neoplasms

encountered in young people. However, the longer course, frequently associated eczema and condylomata of the anus; the smooth, funnel-shaped cicatricial annular constriction, usually felt just within the anus, and in many cases a history of syphilis or a positive Wassermann reaction, combine to make the differential diagnosis.

Tuberculosis, the other type of chronic productive inflammation, may be present in the hyperplastic form, a tuberculoma, which in all respects resembles a protuberant carcinoma, and can be differentiated only by biopsy.



FIG. 332.—ADENOCARCINOMA OF RECTUM
PROTRUDED THROUGH ANUS.

Male, aged fifty-six.

SIMPLE TUMORS.—Chief among these to require differentiation are the adenomata and papillomata.

Adenomata, the most common variety, are usually single and pedunculated, but may be multiple, and the majority are sessile. They are easily recognized by touch and inspection through the proctoscope. Absence of induration at the site of mucosal attachment is characteristic, unless they have undergone malignant degeneration as the multiple variety is prone to do.

A *papilloma* usually presents itself as a large solitary tumor of the villous type, generally situated in the rectosigmoidal area. It produces bowel and general symptoms like carcinoma but feels soft and velvety, bleeds readily on contact and appears injected and wavy

through the sigmoidoscope. Eventually papillomata may undergo malignant change.

Diverticulitis is very exceptional in the rectum. However, an elderly woman admitted to the City Hospital, New York, died of sepsis and intestinal obstruction. What was considered to be an advanced carcinoma completely blocking the rectum, proved at autopsy to be a chronic diverticulitis with multiple foci of infection. A biopsy earlier in the course of the disease would have established the diagnosis (Fig. 272).

The most common site of diverticulitis is the pelvic colon. There is usually a history of a chronic and recurrent inflammatory process, with pain and tenderness localized in the lower left abdominal quadrant. The bowel symptoms closely mimic those of malignant disease. Aside from laparotomy, roentgenograms are of the greatest aid in the diagnosis. In the days before the advent of the x-ray and before pathologic examination of all specimens removed at operation was a routine measure, many cases, diagnosed at laparotomy as carcinoma of the sigmoid, which receded after colostomy, were undoubtedly chronic diverticulitis.

B. *From Diseases of Other Organs.*—The enlarged *prostate* may produce symptoms of rectal obstruction. However, primary carcinoma of the prostate as a rule does not metastasize to nor infiltrate the rectum. Palpation through the rectum detects the asymmetrical enlargement; nodular, hard surface and the fixation of the gland, and usually the mobility of the interposed rectal mucosa.

DOUGLAS' CULDESAC OR PERITONEAL POUCH.—Abnormalities felt in this situation require careful examination, for not only do acute but certain chronic conditions develop here. An important one of these is the *implantation carcinoma* producing an induration described by Blumer as a "rectal shelf." The body of the retroverted uterus, uterine fibroids, carcinoma of the uterus and its cervix, and adenomyoma of the rectovaginal septum may encroach upon Douglas' pouch.

Plastic tuberculous peritonitis may, to palpation, resemble carcinoma of the culdesac, but is to be differentiated by the history, symptoms and other physical signs.

Inflammatory conditions of the ovaries, tubes and pelvic cellular tissue infiltrate the rectum to varying degrees.

In all of these conditions, proctoscopy generally shows an intact mucosa, but there is usually increased secretion of mucus and symptoms of partial obstruction which the examination confirms.

BIOPSY IN ACCESSIBLE GROWTHS OF THE TERMINAL COLON.—Frank carcinoma that can be seen or felt is so characteristic in its appearance and feel to the experienced examiner that biopsy for diagnosis is unnecessary. There are, however, certain cases of tumor, stricture and indurated ulcer that baffle the diagnostic acumen of the most experienced.

In two instances, the rectum was removed (one by the author and another by a colleague) for a very large, callous ulceration of the ampulla, presumably carcinomatous, but careful histologic study of the specimens demonstrated only chronic inflammation. Fortunately no harm resulted as both patients recovered completely. Hence, in these cases of doubtful diagnosis, the author advocates and practices biopsy at once, removing a small section of tissue from the most suspicious area. A negative report may mean that the specimen was taken outside the diseased area and the biopsy should be repeated if the physical findings indicate malignancy.

Progression of an undiagnosed malignant tumor is obviously a greater menace to the patient than any alleged dangers of a properly performed biopsy.

The histologic diagnosis of 172 biopsies done by the author was:

Epithelioma	18
Adenocarcinoma	142
Colloid carcinoma	4
Angiosarcoma	1
Malignant adenomatous polyp	7

WASSERMANN REACTION.—In every case of tumor, stricture or ulcer of the rectum, a Wassermann blood-test should be made. It was positive in twenty-one

(9 per cent) of 238 cases of our series of cancer of the sigmoid and rectum. The coexistence of cancer and syphilis is, therefore, not unusual and warns against mistaking syphilis for cancer of the rectum as well as the possible development of cancer on a syphilitic soil. There is no reliable test of the body fluids for cancer.

Prognosis.—The course of untreated carcinoma of the rectum and sigmoid is invariably fatal. Cripps states that the period of survival after diagnosis in seventy-one unoperated rectal cases was:

<i>Months</i>	<i>Cases</i>
Under 3	8
3-6	25
6-9	23
9-12	8
12-18	33
18-36	4
Average period 7.8 months	

Lazarus-Barlow analyzed the cases of cancer at the Middlesex Hospital, London, with reference to the natural duration of the disease. He found 345 cases of rectal carcinoma, in none of which were any operations performed except palliative (colostomy). In 172 males, the average period of survival after diagnosis was 20.4 months, with extremes of three and eighty-six months; while in 173 females, the average was 25.9 months, with extremes of three and 122 months.

Several important factors enter into the prognosis of carcinomata of the rectum and sigmoid colon: The age of the patient, the histologic type of tumor, its site and extent, other complicating diseases (cardiovascular, renal, pulmonary, diabetes, etc.) and above all too late diagnosis and inoperability when they reach the surgeon.

Operability is the most important factor. For example, if of one hundred cases seen forty are operable and ten of these live five years without recurrence, the cures in the operated cases are 25 per cent, but of the total one hundred cases, only 10 per cent.

Surgical prognosis concerns itself with operative mortality and recurrence *in loco* or metastatically. Shock, hemorrhage, pneumonia, embolism, infection, suppression of urine and pyelonephritis are the chief causes of operative mortality. Shock, pneumonia and suppression of urine are now minimized or eliminated by operating under spinal rather than general anesthesia, by blood transfusion in anemic patients before and, if necessary, after operation, and by hypodermoclysis to maintain equilibrium of the body fluids.

In the present state of our knowledge of the therapy of intestinal cancer, removal of the growth by radical surgery is indicated in all operable cases. The border line of operability has risen in recent years so that involvement of the prostate or vagina does not always bar radical surgery. Recognizable metastasis

in the viscera or peritoneum, of course, precludes radical surgery. Simple infection through the ulcerated tumor may explain enlargement of regional lymph-nodes, hence a patient should not be denied operation because of regional glandular involvement alone.

Pennington collected data of 997 necropsies. The regional nodes were involved in 334, or 33 per cent.

Hausmann of Vienna found the cancer confined to the rectal wall in 112 cases examined postmortem.

McVey studied one hundred specimens removed by operation at the Mayo Clinic. The anorectal lymph-nodes dissected out numbered six plus, for each specimen. No glandular involvement was found in 53 per cent, slight involvement in 30 per cent, and marked involvement in 17 per cent.

McVey concluded that "the size of the growth cannot be relied on as an accurate index of the probable lymphatic involvement. The growths without lymphatic involvement tend to grow into the lumen of the bowel. Growths with slight lymphatic involvement tend to spread by direct extension and are slow growing. Carcinoma of the rectum with extensive lymph glandular involvement tends to metastasize through the lymph stream early. Occasionally metastasis may take place by embolic breaking off into the portal vein. Systematic microscopic examination of all the regional lymph-nodes in carcinoma of the rectum appears, as it does in carcinoma of the stomach, to be the best method of ascertaining an accurate prognosis for the case."

On the other hand, Jones and McKittrick report clinically that although the pathologist found no involvement of the perirectal tissue or glands in 68 per cent of specimens removed by them at operation, nevertheless all but 11.3 per cent, or less, of the patients seen are dead within five years, whether metastases are found outside the bowel or not. Of their patients, 23 per cent, having metastases solely in the regional glands or perirectal tissue lived three or more years.

Miles, from a study of recurrence in four series of operated cases, determined three zones of lymphatic spread, *viz.*, downward into the perianal skin, external sphincter, and ischiorectal fat; laterally into the fascia propria, levatores ani, retroperitoneal lymph glands, the prostate and base of the bladder and, in females, the vaginal wall, cervix uteri and base of the broad ligament; and upward (the most important and rapid), into the peritoneum of the pelvic floor, whole length of the pelvic mesocolon and paracolic lymph-nodes. In a word, all tissues in the lymphatics leading from the primary growth are to be considered "invaded territory" and the operation, reasonably to assure non-recurrence, must include them in a bloc dissection.

Very significant in this connection are the investigations of Broders in the gradation of the malignancy of carcinoma on the principle of cell differentiation. He studied microscopically, independent of the clinical histories, two thousand epitheliomata, 1,628 of which were squamous-cell. Only cells showing mitotic figures and those with deeply staining nuclei were considered differentiated

cells. The presence of numerous irregular mitotic figures tends to raise the grade. If 75 per cent or more of the cells were differentiated, Broders classified the epithelioma as Grade I; if 50 to 75 per cent were differentiated, Grade II; if 25 to 50 per cent, Grade III, and if 25 per cent or less were differentiated, Grade IV.

Recently Rankin and Broders studied 598 cases of carcinoma of the rectum, operated upon at the Mayo Clinic between 1916 and 1925, and graded the malignancy on the basis of Broders' method. In carcinoma showing advanced differentiation, the cells are usually of regular form and may show many or few mitotic figures. Some specimens were so undifferentiated that practically all evidences of gland formation were lost. In general the columnar cells have become irregularly roundish, stain deeply and the mitotic figures, numerous or few, are irregular. The cells of the glands or acini observed in undifferentiated types of carcinomata are irregular in alignment and show only slight tendency to individual differentiation.

Mucoid or colloid material is scant in undifferentiated carcinoma and may be retained in the cells, while in differentiated neoplasms the acini may be so distended with secretion that some of the lining cancer cells may be destroyed by compression.

From their study of 598 cases of carcinoma of the rectum, Rankin and Broders concluded that:

1. The percentage of cases with metastasis rises in direct proportion to the grade of malignancy—from twenty (26.8 per cent) of eighty-two cases, Grade I, to thirty-three (64.7 per cent) of fifty-one cases, Grade IV; while metastasis is absent in inverse proportion to the grade of malignancy—from sixty (73.2 per cent) of eighty-two cases, Grade I, to eighteen (35.3 per cent) of fifty-one cases, Grade IV.

2. The percentage of total good results decreases in inverse, and the percentage of total poor results increases in direct proportion to the grade of malignancy.

3. When metastasis is present, the ultimate good results decrease in inverse proportion to the grade of malignancy and the poor results increase in direct proportion to it.

4. In the absence of metastasis, the grade of malignancy has a markedly less influence on the ultimate result than when metastasis is present.

5. Actually, when metastasis was present, the total of good result forty-eight (20.7 per cent) of 232 cases, and the total poor result 184 (79.3 per cent). In the absence of metastasis, the total of good results was 147 (57.9 per cent) of 254 cases, and the total of poor results was 107 (42.1 per cent).

6. The ultimate results of carcinoma of the rectum, graded I, with metastasis, were almost as good, eight (44.4 per cent) of eighteen cases, as in the case of carcinoma, graded III and IV without metastasis, thirty-one (47.7 per cent) of sixty-five cases.

In no case in which malignancy was graded IV, with metastasis, was a good result obtained.

GRADE OF MALIGNANCY, ULTIMATE RESULT OF OPERATION, AND DURATION OF LIFE
(Rankin and Broders)

	Grade I	Grade II	Grade III	Grade IV
Information	103	293	139	52
Living	58	112	35	8
Good result	55	101	33	7
Longest	9.50 years	11.00 years	10.50 years	10.33 years
Shortest	1.33 years	1.20 years	1.33 years	4.00 years
Average	5.06 years	4.79 years	4.57 years	6.73 years
Poor result	3	11	2	1
Longest	2.25 years	3.41 years	1.91 years	2.75 years
Shortest	1.37 years	1.16 years	1.41 years	2.75 years
Average	1.90 years	2.54 years	1.66 years	2.75 years
Dead	45	181	104	45
Good result	4	13		2
Longest	8.50 years	10.12 years		6.58 years
Shortest	1.83 years	1.17 years		4.00 years
Average	4.81 years	4.67 years		5.29 years
Poor result	25	142 (139 time stated)	87 (85 time stated)	35 (33 time stated)
Longest	7.75 years	7.66 years	6.00 years	7.75 years
Shortest	0.41 year	0.50 year	0.08 year	0.12 year
Average	2.42 years	2.21 years	1.76 years	1.45 years
Total cases	105	299	141	53

In view of the exhaustive data presented by these investigations, it seems fair to conclude that microscopic study by a competent pathologist of a neoplasm, either a biopsy specimen or the removed growth, shows not only the type of tumor but may also have an important bearing on the method of treatment and the prognosis.

Schönbauer has studied the histologic type of tumor in relation to prognosis in 258 of the patients operated upon for rectal carcinoma at von Eiselsberg's Clinic. Deducting the primary deaths, the results were as follows:

Type	Number of Cases	Primary Deaths	Living Over Three Years
Adenocarcinoma	191	29	35 (21.6 per cent)
Cylinder-cell carcinoma	32	5	9 (33.3 per cent)
Colloid and medullary carcinoma	21	2	3 (15.8 per cent)
Epithelioma	12	..	1 (8.3 per cent)
Degenerated polyp	2	..	1 (50 per cent)

With a better understanding of the effects of radiation on malignant neoplasms and improved technic in the application of radium and x-rays, both before and after operation, marked improvement in prognosis is to be anticipated. Hand in hand with these means of strengthening the defense of the organism against recurrence, periodic examinations should be made to detect, at its incipency, any signs of a return of the growth.

CHAPTER XXIX

TREATMENT OF MALIGNANT TUMORS

Treatment comprises palliation and radical extirpation. It is now well established that, in the beginning, carcinoma is localized and that radical extirpation offers the best prospect of cure.

Palliative Treatment.—This is indicated in all radically inoperable cases of carcinoma of the rectum; also in certain operable cases which by reason of age, constitutional or other diseases are unfit for the radical procedure.

General Measures.—Hygienic surroundings, fresh air and mild exercise contribute to the patient's well-being and cheerful words and manner inspire confidence and hope in the cancer patient.

DIET.—When the digestion is good, proper food is a most important factor in maintaining the resistance of the patient to the constitutional effects of the disease. Forced feeding with easily digested foods of high caloric value and small residue is indicated, for example, creamed soups, creamed vegetables, chicken, mutton, beef, sweetbreads, liver, gelatin, cereal, pudding and concentrated foods. As against the normal of 2,500 calories, the cancer patient should receive 3,500 calories.

A specimen diet of this type for one day at the New York City Cancer Institute is inserted for illustration.

<i>6:30 A. M.</i>	<i>Amount</i>	<i>Calories</i>
Stewed prunes	150 gm.	393.6
Oatmeal	100 gm.	407.8
Cream	100 gm.	200.8
Toast	40 gm.	104.2
Coffee	1 cup	117.4
 <i>9 A. M.</i>		
Junket, eggnog	$\frac{1}{2}$ cup	147.0
 <i>12 NOON</i>		
Cream of pea soup	100 gm.	208.0
Roast minced chicken	100 gm.	142.8
Butter	15 gm.	117.4
Lima beans	100 gm.	79.1
Lettuce	40 gm.	9.5
Tomatoes	100 gm.	24.1
Potatoes	100 gm.	96.9
Spanish cream	1 serving	304.0

4:30 P. M.	Amount	Calories
Creamed egg on toast	1 egg	179.2
Butter	15 gm.	117.4
Lettuce	40 gm.	9.5
Cream cheese	50 gm.	215.4
Oats	50 gm.	160.9
Peaches	100 gm.	60.0
Cream	100 gm.	200.8
8 P. M.		
Same as 9 A. M.		147.0
		<hr/> 3442.8

CARE OF BOWELS.—Drinking of water freely and $\frac{1}{2}$ ounce doses of liquid petrolatum night and morning will usually produce sufficient evacuations. When the growth has become obstructive, nothing acts better than the salines. Stasis above a growth may require for its removal enemas of soapsuds, glycerin and ox gall. Enemas of 25 per cent hydrogen peroxid disintegrate hard, dry scybala, but if actual impaction has occurred the mass may have to be broken up by hand.

Irrigations.—If the bowels are regular and little or no discharge present, irrigations are unnecessary. Irrigations are especially indicated in cases with a tendency to hard lumpy stools, and in those having diarrhea with much discharge of mucus, pus and blood, coming from the ulcerated neoplasm or adjacent inflamed or ulcerated mucosa. Among the best solutions for this purpose are potassium permanganate, 1:10,000, and lysol, 1:200. For excessive bleeding, 5 per cent solution of aqueous extract of krameria is very efficient. When the anus or perianal skin is involved, these solutions may be used as warm sitz-baths.

DRUGS.—For anemia and asthenia, a tonic is indicated. Elixir of iron, quinin and strychnin serves well. In advanced cases spiritus frumenti in $\frac{1}{2}$ to 1 ounce doses before meals stimulates appetite and promotes euphoria.

Insomnia not due to pain is combated by bromids, and coal-tar derivatives—veronal, trional and medinal.

Pain causes insomnia and harasses the patient. If evacuating the bowel does not relieve the pain, drugs are indicated, beginning with the mildest and progressing to the most potent. Pyramidon, 5 grains, aspirin, 10 grains, with or without $\frac{1}{2}$ grain doses of codein by mouth, will relieve mild or moderate pain. For severe pain there is no substitute for Majendie's solution of morphin administered by needle in doses of 4 to 7 minims and at as frequent intervals as will keep the patient comfortable. Pain located in the rectum may be mitigated by applying an electric heating pad over the sacrum. For pain in the sacrococcygeal region, prostate, bladder or vagina, a suppository containing morphin sulphate, $\frac{1}{4}$ grain, and extract of belladonna, $\frac{1}{2}$ grain, may be inserted.

There is a natural tendency among medical men to lose interest in this class of patients when they have reached the inoperable stage. Comparatively few appreciate the relief of suffering, prolongation of life in comfort, and in some cases, the gain in weight, that can frequently be accomplished by the simple measures outlined. Proof of this is furnished by our experience at the New York City Cancer Institute where a considerable proportion of the 240 beds is occupied by patients of this class. Occasionally a patient, feeling that he will be more comfortable at home, requests discharge, but usually returns in a few days to be under systematic care and the supervision of those who have made cancer a subject of special study.

Chemical and Other Agents to Affect the Growth.—COLEY'S FLUID.—A mixture of *Streptococcus erysipelatus* and *Bacillus prodigiosus* toxins, Coley's fluid has no effect in carcinoma but may be tried in sarcoma.

COLLOID METALS.—A colloid consists of minute particles of the metal suspended in water by means of an electrical or chemical process. Torres in 1904 first recommended colloidal metals in the treatment of malignant diseases. Since then, preparations of various metals have been tried with the object of relieving pain, shrinking the tumor, or destroying the cancer cells altogether. The colloids most used have been copper, selenium, gold and lead.

Relief and even cure has been reported by some of the advocates of colloidal treatment, but, on the whole, the results have been disappointing. Colloidal copper and colloidal selenium are administered intramuscularly or intravenously; colloidal gold, intramuscularly or by mouth. Colloidal gold has seemed to increase the red blood-cell count in the cases in which the writer has used it. It is an excellent hematinic and general tonic both before and after operation.

Colloidal lead recently has received intensive study, both experimentally on tumor-bearing animals and clinically, due to the work of W. Blair Bell of Liverpool. He used a colloidal suspension of metallic lead in an aqueous gelatin medium, made by the sparking method of Bredig. The preparation is unstable, becoming toxic in two or three days. The action of the lead is an injury of the capillary blood-vessels and thrombosis; and probably also an elective toxic effect on the malignant cells, a property possibly possessed to a higher degree by lead than other colloidal metals. Patients receiving the treatment must be hospitalized and frequent tests of the blood and urine are made.

Untoward effects of the intravenous injections of colloidal lead are malaise, nausea, etc. (lead poisoning), acute anemia, nephritis, neuritis, and focal necrosis of the liver.

Bell used the treatment only in inoperable cases of carcinoma and sarcoma. In cases of large tumors, surgical removal of as much as possible of the growth is necessary. Contraindications to the treatment are nephritis, even of slight degree, obstructive jaundice, anemia and cachexia. Tumors of squamous-cell type are not affected.

From 1920 to March, 1926, Bell had used the lead treatment in 227 cases of malignant tumor, including a large variety of inoperable primary and sec-

ondary carcinomata and sarcomata. Fifty patients lived from one to five years with growth arrested, thirty-one of them being clinically benefited or cured.

From January to July, 1926, Martland, Sochocky, and Hoffman used "a stable colloidal lead" in the treatment of fifteen cases of cancer, including three of rectum, and one of sigmoid. Of these patients two were unimproved and thirteen died.

At this writing, the colloidal lead treatment of human cancer is an experimental method. Doses sufficient to affect the growth are frequently lethal to the patient. The fact remains, however, that for the first time in the history of human cancer, chemotherapy, as employed by Bell, can be directly credited with clinical cure in advanced cases that were inoperable and had resisted irradiation. If further study develops a preparation of lead or other metal less toxic and more efficient than the colloidal lead now used, and employed alone or in combination with irradiation, it will be a blessing to the cancer patient and a boon to humanity.

Palliative Surgery.—**COLOSTOMY.**—Surgeons differ in opinion regarding the employment of colostomy in inoperable carcinoma of the rectum. All physicians and surgeons agree that immediate colostomy is imperative when obstruction is complete. Some hold that colostomy is a calamity to be postponed until obstruction is impending while others advise it in every inoperable case. A middle course seems to the writer to be more rational, depending on the site of the growth and the symptoms it causes. The pain and stenosis characteristic of *anal involvement* are best relieved by colostomy, to which linear proctotomy may be added if deemed necessary. When the growth is in the ampulla, owing to the large caliber of the bowel, complete obstruction does not occur at all, or only when the disease is far advanced. However, the feces irritate a growth in this situation, accelerate ulceration, and increase infection, with consequent frequent discharges, hemorrhage and tenesmus in many cases. When these symptoms are slight or mild, colostomy may be safely deferred, but when pronounced the operation is indicated. Diversion of the fecal current presumably does not retard the growth, but it relieves the tenesmus, and controls hemorrhage, and irrigations per anum and through the stoma largely eliminate the associated infection and prevent the formation of abscess and fistula.

Rectosigmoidal involvement tends to encompass the bowel early. Obstipation and later alternating diarrhea and constipation forewarn obstruction which may occur suddenly from feces impacted above the growth or rarely from invagination of the stenosed segment into the lumen of the bowel below. The author appreciates the distressing condition created by a badly functioning colostomy. A properly performed colostomy usually functions well, causes little discomfort, prolongs life, and prevents or relieves many of the symptoms and complications of inoperable carcinoma of the rectum. The operation is performed readily under local anesthesia and bears a very low mortality unless obstruction is already present.

Cripps performed colostomy in 151 patients. Of 130 operations before com-

plete obstruction only five died, while of twenty-one operated upon after complete obstruction eleven died. Our mortality has been almost entirely in the completely obstructed.

The average life period in ninety-one cases of Hartmann was one year—longest survival, three years; others have reported survivals of five to eight years (Cripps). In fifteen of our cases the average period of life after colostomy was 16.5 months; the longest survival being forty-eight months.

CURETTAGE.—When frequent hemorrhages from an inoperable growth situated in the *lower* rectum are exhausting the patient, curettage of the fungating portion is an old treatment that has been very beneficial in suitable cases. Curettage is applicable to growths situated on the posterior or lateral walls of the rectum. If the tumor is on the anterior wall, there is danger of opening the bladder or urethra in men, and in women of perforating into the peritoneal cavity. The operation is not safe for growths high up in the bowel.

Technic.—The bowel must be empty and washed out with an antiseptic solution just before curettage. Sacral anesthesia, preceded one-half hour by a hypodermic of morphin, $\frac{1}{4}$ grain, and atropin, $\frac{1}{150}$ grain, is most satisfactory. With a large blunt curet the fungating mass above the surface of the bowel is rapidly scraped away. Hot irrigations and gauze packing check the rather free bleeding. After a few minutes' wait, the gauze is removed and radon implants may be inserted into the base of the tumor. A rubber tube is then inserted into the rectum and strips of vaselin gauze packed firmly around it. After two days the packing is removed and the bowel irrigated twice daily with 1:10,000 potassium permanganate solution. In ten days to a fortnight a flat granulating ulcer covers the site of the growth. Curettage may be repeated when bleeding recurs, which is usually in three or four months.

Electrocoagulation followed by curettage and implants of radium is preferable. (See under "Electrosurgery.")

SHORT-CIRCUITING.—Entero-anastomosis may be employed as a palliative measure under the same conditions as those stated for palliative colostomy.

All the advantages of an artificial anus may be obtained without its disgusting features by thus side-tracking the portion of bowel involved in the neoplasm, in cases where there is sufficient sound gut below the tumor to admit joining the upper sigmoid, transverse colon, cecum or ileum to it. This operation is chiefly employed for inoperable growths above the sigmoid flexure. Unfortunately it is seldom applicable for cancers of the upper rectum or sigmoid. When the tumor is situated low in the pelvic colon, there is usually not sufficient healthy bowel below it for anastomosis. However, Stimson, Darling and Tuttle, each employed entero-anastomosis for a neoplasm of the sigmoid flexure. In Tuttle's case the ileum was also involved in the sigmoid growth. He implanted the proximal end of the divided ileum into a longitudinal slit in the anterior rectal wall above the peritoneal reflection. The patient's bowels moved regularly and without pain until his death, forty-five days after operation, due to rupture of the left iliac artery which was involved in the disease.

Generally a side-to-side union is made to eliminate the involved bowel segment, by the usual technic of lateral anastomosis.

PARACENTESIS.—Cases of rectal carcinoma with metastatic deposits in the liver, or general peritoneal carcinosis, frequently develop ascites. The distended abdomen increases discomfort and embarrasses the function of the stomach, heart and lungs. Tapping affords prompt and great relief and should be repeated when the fluid reaccumulates.

RADIOTHERAPY OF CARCINOMA OF THE RECTUM

Roentgen Rays.—Treatment by radium or x-rays is usually designated as irradiation or radiotherapy. In recent years, x-ray machines have been built which produce 200,000 volts or more in the secondary; x-ray tubes devised capable of withstanding this high voltage, and the ionization methods of measuring the intensity of x-ray developed.

One of the serious handicaps to the employment of large doses of x-rays is that a large portal of skin entry must be used to gain the benefit of secondary and scattered radiations. These large doses may be injurious to the normal tissues, the blood and blood-forming organs being especially susceptible.

Bowing and Anderson, and others, have found that Roentgen rays influence primary cancers of the rectum only slightly and the results, even with a voltage of 200,000, or more, are disappointing. On the other hand, the rays inhibit or destroy metastatic nodules. Lymphatic involvements are more susceptible to the rays, and thus their use lessens the liability to metastases. The optimum voltage seems to be 180,000.

Radium.—Radium is a metallic chemical element which was isolated by Mme. Curie in 1898. It disintegrates very slowly, losing only about one-half of its amount in seventeen hundred years. The atomic weight of radium is 226.4 and in the course of its continuous radio-active disintegration, it emits only an alpha-ray (helium) and is thus transformed into radium emanation, or radon, which is produced at a constant rate. The latter is an element which has the physical properties of a heavy condensable gas with an atomic weight of 222.4. Weight for weight, radium emanation is 100,000 times as active as radium element.

Radium emanation, in turn, goes through a series of rapid transformations into elementary solid bodies, named Radium A, Radium B, and Radium C. Only Radium B and Radium C emit the beta- and gamma-rays which are of value in therapy. Hence, the final therapeutic product is identical whether the source be radium salts or radium emanation. The great advantage of the latter is that it can be concentrated and manipulated like any other gas.

The soft alpha-rays are caustic; the beta-rays (soft and hard) are less caustic and more penetrating, while the hard gamma-ray, which is not caustic, penetrates the tissues deeper than any other known ray. For this reason suitable screens are used to eliminate the soft caustic rays, *e.g.*, aluminum, brass,

lead, gold and platinum. The gamma-rays of radium and high frequency x-rays of short wave-length appear to have an identical effect on the tissues, but radium has the superior merit of applicability in close contact with the pathologic lesion.

The appended table shows the stages of transformation of radium:

	Atomic Weight	Half Period of Transformation	Rays Emitted
Radium	226.4	1760 years	alpha
Radium emanation (radon)	222.4	3.86 days	alpha
Radium A	218.4	3 minutes	alpha
Radium B	214.4	26 minutes	beta and gamma
Radium C	210.4	19 minutes	beta, gamma (alpha)
Radium G (end-product, lead) ..	206.		no rays, atom stable

Three methods are available for the application of radium in carcinoma of the rectum: (a) Intratumoral insertion—implantation into the tumor of bare capillary tubes containing the emanation; (b) intrarectal application—direct application of filtered emanation by applicators to the surface of the lesion, and (c) external application—massive doses of filtered radium applied externally for deep radiation, either in packs containing tubes of emanation, or 1 to 4 grams of radium element, heavily screened in a thick lead cylinder. This apparatus is suspended over the patient by a car, on a trolley or crane. The rays may thus be focused at any angle in the same way as those from an x-ray tube and the benefit of cross-firing obtained without skin irritation. Due to the great cost of radium, the latter method is available only in institutions having large quantities of radium, whereas the other methods are more generally applicable.

Intratumoral insertion of emanation capillaries yields the most direct and intensive effects on the growth and is the most efficient and economical dosage. Anatomical relations render its application most effective for rectal tumors situated low and hence accessible.

Dominici originated the method of burying within the tumor radium enclosed in a metal case. Duane of Harvard University by a series of mercury pumps isolated the emanation and the late H. H. Janeway developed the method of interstitial implantation of capillary glass tubes containing radium emanation. The emanation is collected, by the mercury pump, into capillary glass tubes 3 to 5 millimeters long, each tube containing from 0.3 to 2.5 millicuries of radium emanation. Recently tubes of gold or platinum which filter out the soft rays have been used to advantage. Before use the tubes are sterilized by boiling or, simpler, immersed in an alcoholic solution of iodine, and inserted through a trocar needle into the growth (Fig. 333). The emanation thus applied exerts a comparatively mild but continuous action on the tissues until the tube is exhausted. Radium emanation decays at the rate of approximately 15 per cent per day. In about four days one-half of its energy has been used and the total period of active radiation is about two weeks.

The total value in cumulative action of 1 millicurie of radium emanation is approximately 132 millicurie hours, or the equivalent of 1 milligram of radium salt applied to the same area 132 hours.

Qualitatively, the action of the buried tubes is different and more efficient than surface applications of radium emanation. The capillary tubes are inserted within the tumor at accurately determined distances and at a safe margin from

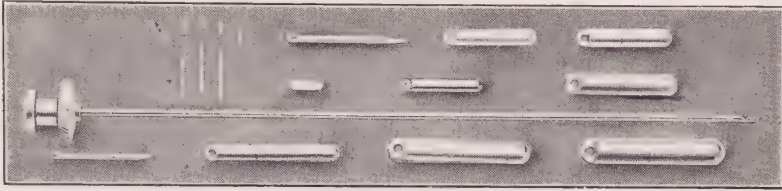


FIG. 333.—TROCAR NEEDLE FOR IMPLANTING RADON SEEDS. CAPSULES AND SEEDS OF VARIOUS SIZES.

the normal tissue. It is estimated that a tube of 1 millicurie strength is lethal to 1 c.c. of cancer tissue.

The *effects of irradiation* are apparently an inhibition of the proliferation of the cancer cells, their later degeneration and destruction; and round-cell infiltration, resulting in the formation of fibrous tissue. This formation of sclerotic tissue, shutting in and depriving the cancer cells of nutrition by cutting off their blood supply, is a major, if not the major, effect of irradiation.

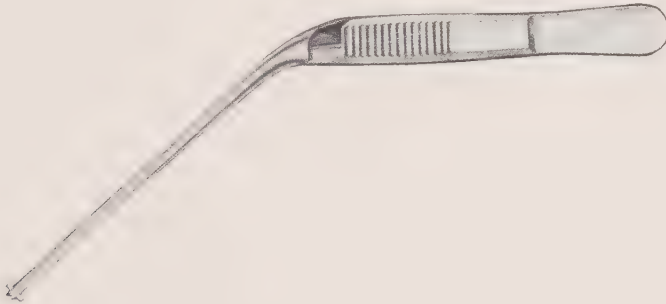


FIG. 334.—FORCEPS FOR HANDLING RADON SEEDS AND INSERTING THEM INTO THE CANNULA.

Excessive dosage produces extensive necrosis of the tumor and sloughing. On the other hand, mild doses of radium or x-rays may stimulate and accelerate the growth of the neoplasm.

Intraperitoneal Insertion.—When correct dosage is used, no gross necrosis results from intraperitoneal insertion of capillaries of radon in carcinoma of the gastro-intestinal tract, although some adhesions may form. I. Levin has demonstrated this fact in many cases at the New York City Cancer Institute. The author has implanted capillaries in several cases of inoperable carcinoma of the rectum and sigmoid while performing a colostomy. No unfavorable reac-

tion has occurred in any case, but marked benefit in checking the growth and relieving symptoms has been uniformly observed.

Even in some cases of cancer radically removed, *e.g.*, cancer of the sigmoid, it is advisable to insert capillaries of radon in the base of the mesentery at the time of operation to prevent recurrence.

Secondary Effects of Irradiation.—The rest of the organism is not indifferent to irradiation. In order to obtain an effective dose at the tumor a far greater quantity of *x-rays* must enter the organism. The baneful influence of overdosage is exerted especially on the blood and blood-forming organs. Consequent anemia, if severe, robs the patient of this natural protective coöperation and may offset the beneficial effects of the rays. Frequent *blood-counts* are the best guide of the systemic effect of irradiation and in determining the intervals between treatments.

Other systemic effects sometimes noted after deep x-ray therapy are nausea, vomiting, weakness, and urgency, which subside in twenty-four to forty-eight hours; rise of temperature and general toxemia. Most of these symptoms can be avoided by a suitable adjustment of the x-ray dose and by maintaining a circulation of fresh air in the treatment room.

When *radium* is applied locally, systemic effects are slight or absent. The rectal mucosa, however, is peculiarly susceptible to irradiation. A severe proctitis may be initiated, with pain, tenesmus, discharge of mucus and blood, and eventual ulceration. Ulcers of this type are resistant to treatment, healing slowly. A perineal abscess may be a local complication of intratumoral implantation.

Tumor Reaction to Radiation.—Although malignant cells, in general, are more sensitive to the action of x-rays and radium than the normal tissues, tumors of different types vary widely in their response to radiation. A tumor of the same type may, in one case, be radiosensitive; in another, radioresistant. This variability in reaction is a prime difficulty in determining the correct initial dosage in a given case.

Infection seems to have little or no effect on the rate of growth of the tumor, but seriously impairs the response of the neoplasm to irradiation.

Classification.—Clinically, for purposes of treatment, cases of rectal carcinoma may be divided into two classes: Favorable and unfavorable. Favorable cases comprise the operable class, and when age, constitutional condition of the patient and other factors are equal, the writer holds that the best and most permanent benefit results from radical extirpation.

The unfavorable class falls into three groups: (a) Cases ordinarily operable but in which, by reason of age, other diseases or metastases, operation is contra-indicated; (b) border-line cases where metastases are probable, and (c) the hopelessly advanced cases, and recurrences after operation. For the latter group, no form of active treatment, be it irradiation or surgery except colostomy when necessary, yields benefits commensurate with the effort. Hygiene, diet, good nursing and medication frequently give the patient a longer lease on life in greater comfort than does intensive treatment.

Cases under (a) should receive intensive irradiation, to the degree the complicating conditions permit, with the object of arresting or causing permanent regression of the tumor.

Intensive radiation comprises radon implants, filtered radium applied to the surface of the tumor, and external radiation by radium or x-rays. The latter are more applicable for metastases and to prevent recurrence.



FIG. 335.—LIGHT AREA AROUND ANUS IS A RADIUM BURN DUE TO OVERRADIATION OF A CARCINOMA OF THE RECTUM.

The tumor is protruding through the anus. Male, aged fifty-four years.

Implants of 0.5 to 2 millicurie strength are inserted at equal spaces into the tumor through the proctoscope with a trocar needle (Fig. 325), but more accurately in low-lying tumors, under guidance of the finger, aided, if necessary, by surgical exposure of the growth. Usually anesthesia is not necessary, but when required, sacral (novocain) anesthesia is most satisfactory.

In women, with tumors situated low and especially if they involve the ante-

rior rectal wall, applicators of filtered emanation are placed over the posterior vaginal wall, the rest of the vagina being protected by gauze packing.

In border-line cases, group (*b*), the combined experience and judgment of the surgeon and radiotherapist serve the best interests of the patient. In these cases an exploratory abdominal incision to determine the presence of metastases is justifiable. Metastatic deposits exclude radical surgery on the rectum but



FIG. 336.—RADIOGRAM OF GOLD SEEDS OF RADON IMPLANTED IN AN EPIDERMOID CARCINOMA OF THE ANAL CANAL.

Female, aged fifty-six. Perineal extirpation of rectum three weeks after irradiation. Patient well, no recurrence, and good control of feces two years later.

indicate moderate irradiation. At the same time, radon implants can be inserted accurately through the peritoneum into the upper portion of the tumor, and if deemed necessary, a temporary colostomy may be established. On the other hand, when no metastases are discovered, radical excision may be undertaken with greater confidence of success.

Further, preliminary irradiation of a border-line growth encircling only a portion of the rectal wall gives better prospects of complete eradication of the lesion by subsequent excision.

Colostomy.—Irradiation of annular growths is usually followed by a permanent fibrous stricture, hence a preliminary colostomy is established. Opinion differs as to the wisdom and necessity of colostomy in all cases before irradiation. If the bowel lumen is not unduly constricted by the growth, colostomy may be omitted or deferred, but becomes imperative when obstruction is threatened.

Recurrence.—Patients apparently cured of their malignant condition should be examined at stated intervals to detect the first signs of recurrence. Recur-

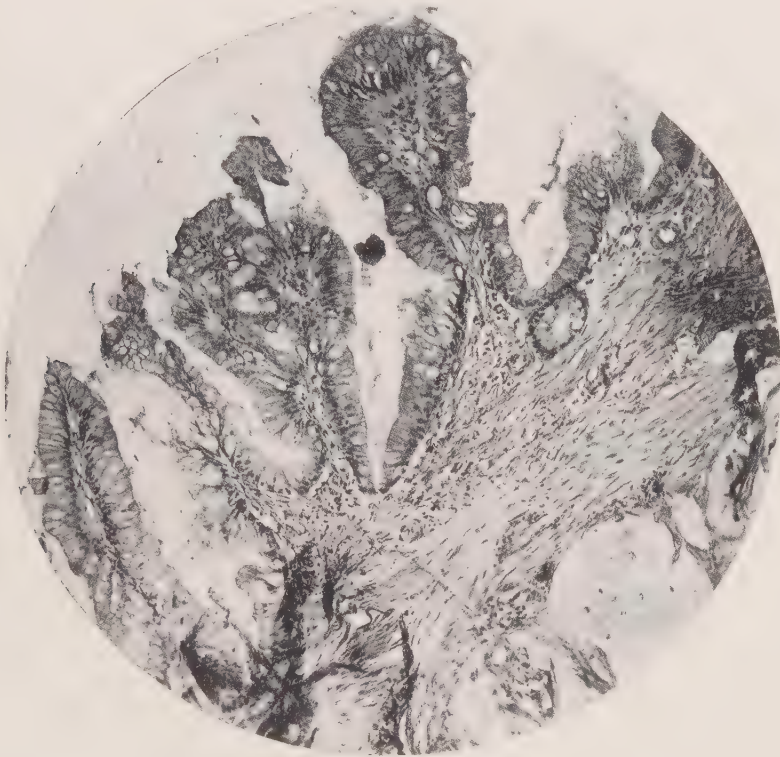


FIG. 337.—PHOTOMICROGRAPH OF EPIDERMOID CARCINOMA OF ANUS.
Same patient as Fig. 336.

rences, unless treated promptly and vigorously, quickly develop into a state beyond therapy. The effects of irradiation of cancers of the rectum which respond favorably are a fibrosis and shrinkage of the tumor, enlarged bowel lumen (rare), cessation of bleeding, diminished discharge, relief of pain, lessened toxicity and gain in weight and strength.

Epithelioma of the Anus.—Owing to its situation, epithelioma of the anus is the most accessible of all malignant anorectal neoplasms for the application of irradiation. The plan which the author has followed with great satisfaction

RESULTS OF RADIOTHERAPY OF CARCINOMA OF THE RECTUM

Source	Patients	Remarks	
Quick (1917-1921)	161 nearly all advanced cases	14 patients clinically free from disease from 4 months to 4 years. Palliation from 1-3 years in several cases.	
Kelly and Ward (Dec., 1911, to Jan., 1922)	200 (12 operable) 36 per cent recurrent	13 of the 22 "cured" patients were well at 5 to 10 years after irradiation. Per cent of total cases cured (1 to 10 years), 11. Number of cases benefited by radium, 124, or 62 per cent; not benefited, 54, or 27 per cent. Colostomy was done in 48 cases; of these only 3 were cured (6.3 per cent) but palliation was greatest (68.7 per cent).	
RESULTS IN TWELVE CASES OPERABLE ON ADMISSION			
	Radium, Per Cent	Radium and Operation (Resection), Per Cent	Radium and Colostomy, Per Cent
Well	2-50	3-50	0
Improved	2-50	3-50	0
Unimproved ..	0	0	2-100
Schreiner State Institute for the Study of Malignant Disease, Buffalo, N. Y. (1914-1925)	168 (153 advanced) adenocarci- noma of rectum 14 (7 advanced) epithelioma of anal ring	Clinically well to (7 cases, 6 mos. to 2 years, 5 mos.; 3 cases, 3 years) 1, 4 years	Palliation or improved 18 1
Bowing (Mayo Clinic, 1919-1924) .	43	Radium alone or combined with x-rays. Rectum later resected for carcinoma in all, preceded by permanent colostomy in 35 cases. Cases traced, 33: Of these 15 dead; 10 living 3 years after first irradiation, 6 between 2 and 3 years, and 2 under 1 year.	

in six cases is intratumoral implantation of radon capillaries, followed by radical excision two to four weeks later. This interval is necessary to obtain the fibrotic effects of the emanation on the growth.

Some authorities advise surgical removal at the same time of the previously irradiated inguinal lymph-nodes. If the cancer cells have already reached the inguinal lymphatics, the chance of their complete removal by operation is slight. The preferable course is to irradiate in all cases both inguinal regions intensively with x-rays and radon applicators.

The question of postoperative irradiation in all cases of anorectal cancer to prevent recurrence should, in general, be answered in the affirmative. High frequency x-rays are more adaptable for this purpose. A complete course of Roentgen rays consists of exposure of four fields: Anterior, posterior, and two lateral, in the pelvic area. Each field is treated three times in séances of thirty minutes each, making a total of twelve exposures in a period of six or seven weeks. This course should be repeated in six to twelve weeks. If the leukocytes fall markedly (leukopenia) the interval between treatments is lengthened.

Only the general principles of treatment have been indicated. Each case must be individualized. The details of suitable and efficient irradiation treatment can be learned only by working with men who have had broad clinical experience with these agents. One important fact, however, deserves emphasis, namely, that in applying radium, the first dose is the most effective and therefore should, if possible be gauged to destroy all the cancer cells. An effective dose ranges from 2,000 to 5,000 millicurie hours. Tumors that have been irradiated are less responsive to subsequent treatments. The dose when too small is inefficient and may stimulate tumor growth.

The author recently visited several medical centers in Europe. At most of them irradiation of rectal carcinoma had proved unsatisfactory and had been discontinued except as a palliative measure and prophylactic after operation. The Radium Institute and the Middlesex Hospital of London employ the method exclusively in a small percentage of cases. In America, several institutions, equipped with high voltage x-ray apparatus and sufficient quantities of radium, are working with enthusiasm. Large statistics are not yet available, but the results already obtained show that the irradiation has a definite place in the treatment of carcinoma of the rectum.

Carcinoma of the rectum presents a formidable therapeutic problem. Radium and x-rays alone seldom cure. A more rational plan of treatment and one which conserves the best interests of the patient is a combination of irradiation with electrocoagulation and surgery.

ELECTROSURGERY

Surgical Diathermy (Endothermy).—When an electrical current of high frequency is passed through tissues, its electrical energy is transformed into heat energy, and at a faster rate than the heat-regulating mechanism of the body

can dissipate. The degree of heat developed in the tissues varies directly with the amount of current, size of the electrodes, duration of the application and the resistance of the tissues treated. According to Joule's law, the developed heat varies directly with the resistance of the conductor through which the current flows. Tissues are resistant in the following order: Bone, fascia, tendon, skin, muscle and fat.

Heat concentration can be regulated by varying the size of the electrodes. With two electrodes of equal size, the heat is evenly distributed through the intervening tissues. When two electrodes of different sizes are used, the density of current and consequent heat production will be greater in the region of the smaller than of the larger electrode. Advantage is taken of these principles to localize any desired degree of heat at a definite point. Endothermy may be used for desiccation, coagulation or cutting of the tissues.

In 1907, Pozzi of Paris announced "the cure of malignancy" by fulguration with sparks from the terminal of an Oudin resonator. Doyen, also of Paris, later was instrumental in improving the fulguration machine and making it bipolar (d'Arsonval current), so that the tissues were coagulated. In present-day apparatus the Oudin resonator, by a single winding, is converted into an autotransformer. The amounts of voltage (current pressure) and amperage (current density) can be regulated by varying the ratio between primary and secondary turns of the Oudin coil.

Histologic Changes.—Clark, Morgan and Asnis demonstrated the histologic changes produced in tissues by this current, and Ward has confirmed their findings. The effects are either a desiccation or a coagulation of the tissues.

Electrodesiccation.—Electrodesiccation is produced by a monopolar current of the Oudin type, of relatively high voltage, low amperage, and high frequency of oscillation, 1,250,000 per second. After the treatment by desiccation, the cells appear shrunken and shriveled and nuclei close together, the whole presenting a mummified appearance (mummification necrosis). The blood-vessels are thrombosed and round-cell infiltration occurs in adjacent zones. Desiccation is of no practical value in the treatment of anorectal carcinoma.

Electrocoagulation.—Electrocoagulation is produced by a bipolar current of the d'Arsonval type of low voltage, high amperage and damped oscillations of 1,250,000 frequency per second. The heat, generated by this current in the tissues, coagulates both the cancer and stroma cells into a structureless, homogeneous mass (coagulation necrosis). The heat penetrates beyond the area of total destruction, devitalizing cancer cells without permanent injury to the normal tissues. The liability to recurrence and metastases is thus diminished. Histologic study and clinical observation have shown that cancer cells, especially the undifferentiated type, are more vulnerable to heat than normal cells.

With a strong bipolar current, the area of total destruction is 0.5 to 1 centimeter around and at the point of the needle. Moreover, undue permeation of heat may cause devitalization and subsequent slough of the tissues adjacent to the coagulated area. For this reason overtreatment of lesions situated near

large blood-vessels or vital organs must be avoided. At the same time, our aim is to destroy the entire tumor at one sitting.

TECHNIC.—The technic is quite simple but experience acquired by practice is essential to judge the extent of coagulation and of slough later. Sheet rubber insulates the patient's back from the operating table. The indifferent electrode is a heavy copper wire mesh, 8 by 8 inches, suitably covered and moistened, and placed under the patient's hips. The active electrode is an ordinary cambric needle in an insulated handle. For coagulation of a tumor in a cavity, as the

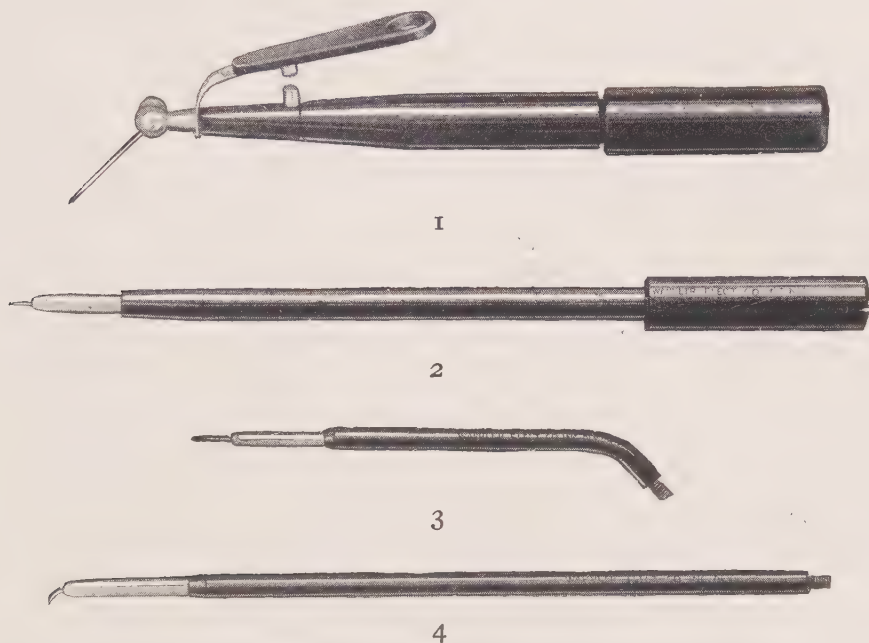


FIG. 338.—1. ENDOTHERMY HANDLE. 2. STRAIGHT ENDOTHERMY LANCET WITH REVERSIBLE PROTECTIVE SHIELD. 3. CURVED ENDOTHERMY LANCET ABOUT 5 INCHES LONG. 4. STRAIGHT ENDOTHERMY LANCET $8\frac{1}{2}$ INCHES LONG WITH CURVED POINT.

rectum, use is made of long knitting needles, insulated with rubber, except the distal centimeter.

The strength and quality of the current are tested on metal or a piece of raw beef before applying the needle. The current is controlled by hand or a foot switch. The needle is inserted into the tissue to the desired depth and the current turned on until a white zone or bubbling appears around the needle. It is then withdrawn and reinserted at another point. If too long an application is made, the tissues are carbonized, which is considered poor technic.

Cutting Current.—The cutting current is produced by passing an oscillating current from a transformer and condenser through two De Forest (radio) tubes arranged in parallel. The cutting current is of lower voltage (500 volts), lower amperage (5 milliamperes) and higher frequency (1,500,000) than the

currents used for desiccation and coagulation. The oscillations are "undamped," that is, the waves have an equal amplitude; whereas in desiccation and coagulation they are "damped," *i.e.*, of unequal wave-length. The cutting current is now available in the endotherm of Wyeth and spark-gap machines.

The cutting is not actually done by a "knife" but by a steel needle fixed at the end of an insulated holder. Very slight contact of the needle with the tissues causes them to fall apart by "molecular disintegration" of the tissue cells. The cut surface presents a very superficial carbonization. Beneath this the tissues



FIG. 339.—PORTABLE ENDOTHERM.

show slight desiccation and coagulation effects, 0.1 millimeter in thickness, a result of the slight heat developed. This tissue change usually does not prevent primary union but is sufficient to seal the lymphatics and capillaries. This reduces operative trauma and may limit somewhat the possible dissemination of cancer cells.

The two electrothermic methods of value in the treatment of carcinoma of the rectum, are electrocoagulation and the cutting current. Efficient machines are now obtainable which combine in one apparatus the currents for coagulation and for cutting. By simply turning a switch the operator can instantly change from one current to the other at will.

The groups of cases in which electrothermic methods have given us the greatest satisfaction are epithelioma of the anus and adenocarcinoma of lower rectum. We have employed endothermy both for primary growths and for local recurrences, many of which stenose the lumen.

In epithelioma of the anus, where wide and radical removal is indicated, our procedure has been, to first irradiate the tumor with buried radon seeds. The entire neoplasm, three to six weeks later, is circumscribed by a zone of coagulation which seals vessels and tends to prevent metastases. The isolated area is now excised with the endotherm knife and seeds of radon are again buried into the base.

Obviously, because of anatomical relations, electrothermic methods are of very limited service in radical excision of adenocarcinoma of the upper rectum. For accessible inoperable, or stenosing growths, electrocoagulation of the tumor is followed by its curettage to the level of the bowel wall. Seeds of radon are then implanted in the base. Hemorrhage by this procedure is much less than from curettage of an uncoagulated malignant tumor.

The regional lymph-nodes, especially the inguinal in anal epithelioma, are exposed to a course of treatment by heavily filtered x-rays.

Anesthetic.—For tumors of the anorectal region, the anesthesia of choice is sacral, preceded by morphin, $\frac{1}{4}$ grain, and atropin, $\frac{1}{150}$ grain, hypodermically. Gas-oxygen is safe for general anesthesia, but ether is dangerous as an explosion may occur.

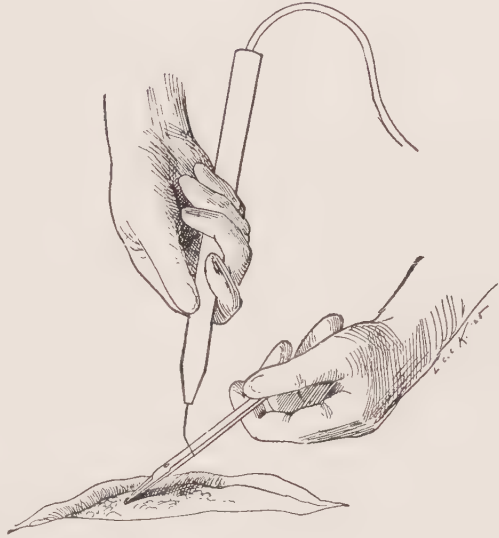


FIG. 340.—COAGULATION OF BLOOD-VESSELS.
Clamp grasping vessel serves as active electrode.
(Kelly, *Gynecology*, D. Appleton & Co., New York.)

PERCY CAUTERY

The chief principle of the Percy cautery method of treating cancer is that the cancer cell is rendered sterile when subjected to a continuous temperature of 45° C. (113° F.) for ten minutes. The cancer-bearing tissues are "pasteurized," not carbonized. Carbon limits heat penetration.

Kiger used this method, between 1913 and 1922, in forty-five cases of inoperable carcinoma of the distal 4 inches of the rectum. After dividing both sphincters with the cautery knife, the Percy cautery is applied to the growth through a water-cooled speculum devised for the purpose. The heating iron

remains in position from forty to sixty minutes, or until the mass is heated throughout and covered with a "tough, non-absorbing plaque or cap."

Kiger states that there was no operative mortality in his forty-five cases and reported a clinical cure of nine, five and three years' duration in three women, aged respectively, thirty-eight, sixty-two and thirty-eight years.

CANCER FACTS AND OPINIONS

As a fitting conclusion to the chapter on malignant disease the resolution adopted unanimously by the International Symposium on Cancer Control, held under the auspices of the American Society for the Control of Cancer at Lake Mohonk, New York, September, 1926, is appended.

The number of persons officially present was 109, of whom sixteen were guests from the principal countries of Europe. All were active students of the cancer problem. The resolution reads:

Although the present state of knowledge of cancer is not sufficient to permit the formulation of such procedures for the suppression of this malady, as have been successfully employed for the control of infectious diseases, there is enough well established fact and sound working opinion concerning the prevention, diagnosis and treatment of cancer to save many lives, if this information is carried properly into effect.

1. The causation of cancer is not completely understood, but it may be accepted that for all practical purposes cancer is not to be looked upon as contagious or infectious.
2. Cancer itself is not hereditary, although a certain predisposition or susceptibility to cancer is apparently transmissible through inheritance. This does not signify that, because one's parent or parents or other members of the family have suffered from cancer, cancer will necessarily appear in other persons of the same or succeeding generation.
3. The control of cancer, so far as this subject can be understood at the present time, depends upon the employment of measures of personal hygiene and certain preventive and curative measures, the success of which depends upon the intelligent coöperation of patient and physician.
4. Persons who have cancer must apply to competent physicians at a sufficiently early stage of the disease, in order to have a fair chance of cure. This applies to all forms of cancer. In some forms early treatment affords the only possibility of cure.
5. Cancer in some parts of the body can be discovered in a very early stage, and if these cases are treated properly the prospect for permanent cure is good.
6. The cure of cancer depends upon discovering the growth before it has done irreparable injury to a vital part of the body and before it has spread to other parts. Therefore, efforts should be made to improve the methods of diagnosis in these various locations and the treatment of the cancers so discovered.
7. The public must be taught the earliest danger signals of cancer, which can be recognized by persons without a special knowledge of the subject, and induced to seek competent medical attention when any of these indications are believed to be present.
8. Practitioners of medicine must keep abreast of the latest advances in the

knowledge of cancer in order to diagnose as many as possible of the cases of cancer which come to them.

9. Surgeons and radiologists must make constant progress in the refined methods of technic which are necessary for the diagnosis and proper treatment not only of ordinary cases, but of the more obscure and difficult ones.

10. There is much that medical men can do in the prevention of cancer, in the detection of early cases, in the referring of patients to institutions and physicians who can make the proper diagnosis and apply proper treatment, when the physicians themselves are unable to accomplish these results. The more efficient the family doctor is, the more ready he is to share responsibility with a specialist.

11. Dentists can help in the control of cancer by informing themselves about the advances in the knowledge of the causes of cancer of the buccal cavity, especially with relation to the irritations produced by imperfect teeth and improperly fitting dental plates. They can also help by referring cases of cancer which they discover to physicians skilled in the treatment of cancer in this location. It may be doubted whether all dentists fully realize the help which can be obtained from x-ray photographs in revealing not only the state of the teeth but the condition of the bone surrounding them.

12. Medical students should be instructed in cancer by the aid of actual demonstrations of cancer patients, and this to a sufficient extent to give them a good working knowledge of the subject.

13. The most reliable forms of treatment, in fact, the only ones as yet justified by experience and observation, depend upon surgery, radium and x-rays.

14. Emphasis should be placed upon the value of the dissemination of the definite, useful and practical knowledge about cancer, and this knowledge should not be confused nor hidden by what is merely theoretical and experimental.

15. Efforts toward the control of cancer should be made in 2 principal directions: (1) the promotion of research in order to increase the existing knowledge of the subject, and (2) the practical employment of the information which is at hand. Even with our present knowledge many lives could be saved which are sacrificed by unnecessary delay.

CHAPTER XXX

SURGICAL TREATMENT OF CARCINOMA OF THE RECTUM AND SIGMOID

Although other methods of treatment have produced palliation and some cures, radical excision still remains the method of choice in operable cases of carcinoma of the rectum, and is the only treatment offering any hope of cure for carcinoma of the sigmoid.

Operability.—Proctectomy, to offer any reasonable prospect of cure, must remove a liberal section of bowel above and below the malignant tumor, together with the tissues in the area of lymphatic spread. The question of operability places a serious responsibility on the surgeon. When the general condition of the patient is from fair to good, radical excision can be performed in all cases of cancer of the rectum and sigmoid flexure, regardless of size or duration, provided the involved gut is movable. It must be remembered, however, that even in these cases in which the disease is apparently confined to the bowel proper, metastases, which oppose radical excision, may be present.

The site of involvement has an important bearing on operability.

As observed by Miles, a rectosigmoidal growth is usually operable because its tendency to circular infiltration with stenosis, forces the patient to seek advice for symptoms of obstruction while the disease is still in an early stage and before metastases have occurred.

Likewise a growth originating in the anal canal is usually operable as the patient seeks relief early for the pain which characterizes it.

When, however, the growth is situated in the ampulla, due to the larger bowel lumen, no urgent symptoms may be present until the disease is in a late phase. Digitally the rectum may be movable, but as the tumor may have existed for a considerable time, metastases may have occurred to the lymph-nodes of the pelvic mesocolon. For this reason the author agrees with Miles that operability in some cases of upper rectal growths cannot be determined until the abdomen is opened and the extent of local or metastatic involvement determined by palpation. However, in view of the excellent and permanent results obtained in many cases of limited growth in a freely movable ampulla by perineal excision alone, the question of routine exploratory laparotomy is debatable. The preferable course is to decide each case on its merits, taking into consideration the age of the patient and complicating conditions.

Posterior extension may be inflammatory and not contra-indicate operation. Anterior extension and fixation to the prostate contra-indicates proctec-

tomy. Involvement of the posterior vaginal wall is more easily managed than extension to the uterus and ovaries. Total hysterectomy has been performed successfully in a few cases in which the organ was involved. The invaded prostate, entire or in part, has also been removed. In other words, some surgeons have increased the percentage of operability by including cases usually considered border-line or inoperable. This has naturally increased the operative mortality but the results in five-year cures may justify the procedure, if the patient elects the risk in an otherwise hopeless condition.

Contra-indications to radical excision are, in general, acute obstruction, fixation of the bowel by extensive involvement of adjacent organs, and remote metastases to the liver, lungs, bones or other organs, or to distant lymph-nodes. The general condition of the patient, senility, cachexia, chronic bronchitis, pulmonary tuberculosis, diabetes and serious diseases of the cardiovascular system oppose radical surgery. Obese patients lack resistance to shock and infection and are not suitable for the combined operation but frequently stand perineal or sacral excision very well.

In young persons the growth is rapid, the radical operation is borne well, but recurrence is usual. Because of the broader pelvis, operation from the purely technical standpoint is easier in women than in men.

Operability, then, varies with different surgeons, in accordance with their selection of cases and experience and skill in operating. Since the operative mortality is, in general, in direct ratio to the percentage of operability, a comparison of the statistics of different surgeons becomes difficult, as their standards of operability vary widely. The percentage of operability among surgeons of large experience is: Witzel, 25 per cent; Czerny, 71 per cent; von Bergmann, 80 per cent; Payr, 43 per cent; Miles, 29.3 per cent in 587 cases; von Eiselsberg, 65 per cent; Küttner, 32 per cent in 1,021 cases; the Mayo Clinic, 34.9 per cent in 1,727 cases.

The subjoined table gives the operability in location incidence of 152 cases in our series:

Location	Radically Operable	Inoperable
Anal	10	8
Rectal proper	64	40
Rectosigmoidal	14	14
Sigmoidal	1	1
TOTAL	89 (58 per cent)	63 (42 per cent)

Of the radically operable cases, thirty-two were operated upon by the author and thirty-seven by other surgeons.

Apparently inoperable tumors sometimes become movable and operable after colostomy and irrigations which diminish infection. Radium and x-ray treatment shrink the growth but the fibrosis produced by irradiation makes the operation technically more difficult.

Historical Considerations.—The technic of excision of the rectum for carcinoma has developed during a century, beginning in the pre-anesthetic and pre-antiseptic days.

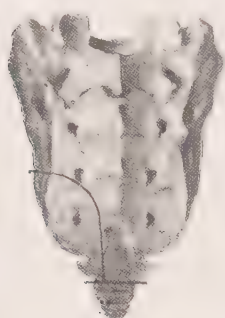


Fig. 341.—Kraske's.



Fig. 342.—Hochenegg's.

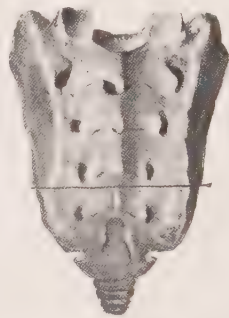


Fig. 343.—Bardenheuer's.



Fig. 344.—Rose's.



Fig. 345.—Von Heinecke's.

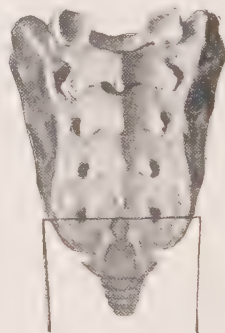


Fig. 346.—Levy's.

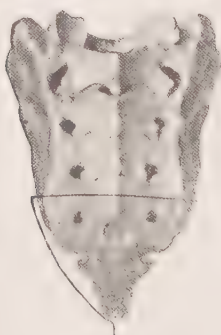


Fig. 347.—Rhydygier's.



Fig. 348.—Hegar's.

FIGS. 341-348.—METHODS OF SACRAL RESECTION IN EXTIRPATION OF THE RECTUM.

Lisfranc, in 1826, performed the first successful excision of the rectum through the perineum and, in 1833, published an account of his method in the *Mémoires de l'Académie royale de Médecin*, Volume II, page 296.

Sacral or Posterior Excision (Kraske's Operation).—To obtain better access to the tumor Verneuil removed the coccyx. Kraske increased accessibility by removing the left lower portion of the sacrum together with the coccyx, and popularized the operation in a report of two cases before the fourteenth congress of German surgeons in Berlin, in 1885.

A number of surgeons have modified the posterior operation by dividing the sacrum at different levels and in different directions. Except in low-lying cancers, the majority of surgeons excise the coccyx only. Resection of bone reached its maximum with Rose who removed the coccyx and sacrum just below the level of the second foramen. This practically obliterated the support furnished by the bony floor of the pelvis.

Bone-Flap Operation.—Levy, Rhen-Rhydygier, Hegar and Tuttle, to obviate the loss of support by removal of the bone, preserved it, in a flap of the tissues (osteoplastic resection) which was sutured back in place after excision of the rectum. However, infection (septic osteitis) resulting in slow healing, and other disadvantages have practically eliminated the bone-flap procedure, and, indeed, it is unnecessary.

Vaginal Excision.—In 1890 Desquins suggested vaginal proctectomy. During the next decade McArthur, Vautrin, Price, Gersuny and others practiced the method, and in 1900 J. B. Murphy in a report of five successful cases outlined the technic.

Combined Operation.—ABDOMINOPERINEAL, ABDOMINOSACRAL OPERATION. —In 1892, Maunsell deliberately opened the abdomen to mobilize the rectosigmoid segment; by the aid of mattress-sutures invaginated and drew the malignant growth through the anus, resected the neoplasm and sutured the bowel end-to-end.

In 1896, Quénu, Reverdin and Tuttle, performed the combined abdominoperineal operation. Reverdin isolated the rectum first, while Quénu first opened the abdomen. An artificial anus was established, the sigmoid mobilized and superior hemorrhoidal artery tied to control hemorrhage. Then the rectum was dissected out from below, either through the perineal or the sacral route. These efforts created what is known as the *combined operation* for carcinoma of the rectum, to the perfection of which Miles has contributed much.

Kocher introduced a valuable point in the technic in closing the anus by suture to prevent infection, as the first step in the operation.

Abdominal Operation.—In 1901, Edebohls and Mann advised the one-stage abdominal operation for high rectal cancer in women—laparotomy, hysterectomy, resection of the malignant section and end-to-end anastomosis of sigmoid and rectum.

There are thus five general methods of accomplishing extirpation—the *perineal*, the *sacral*, the *vaginal*, the *abdominal*, and the *combined*.

No single method is suitable for all cases, and the surgeon, to cope successfully with this formidable condition, must be familiar with the different methods and their modifications, and fit the operation to the individual case.

Preparation of the Patient.—About one week is required to prepare a patient for the operation of radical excision. Rest conserves the patient's strength. Forced feeding with a nitrogenous diet, meat, concentrated broths, and refined cereals, together with drinking of water freely, is best calculated to increase the patient's strength. Oral hygiene should be carefully attended to. An empty bowel is essential at the time of operation. Small doses of saline every morning for a few days and a dose of castor oil forty-eight hours before operation are usually effective. Irrigation of the bowel once or twice daily with permanganate solution 1:10,000, or 25 per cent hydrogen peroxid (peroxid one part, water three parts) diminishes local infection. Intestinal antiseptics as salol, 20 or 30 grains daily, are indicated. These measures will go far to overcome the toxic state present in many of these patients. Some patients

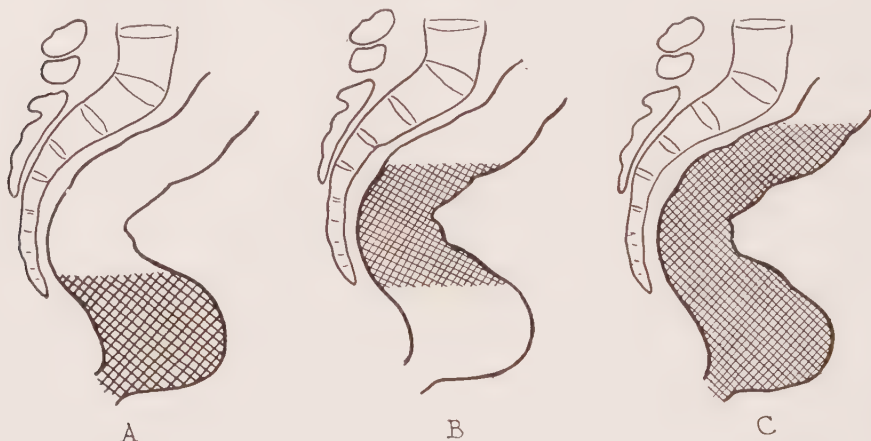


FIG. 349.—SEGMENT OF RECTUM REMOVED IN *A*, AMPUTATION; *B*, RESECTION; *C*, TOTAL EXCISION.

appear quite robust and healthy and do not require prolonged preparation. Advantage is taken of this period to make a complete study of the blood, including the blood chemistry and Wassermann test, and a test of kidney functions. If indicated, a transfusion of blood should be given the day before the operation.

Colostomy.—In carcinoma of the rectum colostomy is performed either as a palliative measure or preliminary to operation. Some surgeons advise *palliative colostomy* in every case of inoperable carcinoma of the rectum. As diversion of the fecal current has but little effect on the growth of the tumor, colostomy should be done in inoperable cases only when there are definite indications. These are a small bowel lumen giving symptoms of obstruction, fecal retention with resultant toxicity, and free discharge of blood and pus not controlled by irrigations, electrocoagulation and curettage, or treatment by irradiation.

Colostomy preliminary to radical excision of the rectum is desirable. Experience proves that a permanent colostomy minimizes infection and thereby pro-

motes wound healing and reduces the mortality of rectal extirpation for carcinoma. It is always indicated when feces, accumulated above the growth, cannot be evacuated. Colostomy shortens the time of the abdominoperineal operation and avoids the liability to tension and sloughing which sometimes ensues when the proximal bowel is sutured to the anus. When the growth is small and only the distal 3 or 4 inches of the rectum are to be amputated through the perineum, colostomy is frequently unnecessary. A colostomy should always be established one to three weeks before doing a sacral excision (Kraske). The stoma should function well before the radical procedure is undertaken. Meanwhile the bowel distal to the stoma is irrigated three times daily with an antiseptic solution. By palpation through the colostomy incision, the surgeon usually gains valuable data as regards the extent of neoplastic involvement. When performing the abdominoperineal operation in one stage, the colostomy is done at the same time. The technic is given under the chapter on Colostomy.

Choice of Operation.—This is governed by the age of the patient, his general condition, complicating diseases and by the site and extent of the growth.

Perineal excision is indicated for neoplasms situated in the lower 4 inches of the rectum or at the anus.

Sacral excision accomplishes removal of tumors in the ampulla and upper third of the rectum.

Abdominoperineal (combined) operation is essential for cancers involving the rectosigmoid or lower pelvic colon.

Resection, in one or two stages, meets the indications for neoplasms in the sigmoid proper.

Anesthesia.—Shock, due in great measure to lowering of blood-pressure by general anesthesia, contributes largely to the operative mortality. To avoid this, sacral or spinal is substituted for general anesthesia. In experiments on animals, Crile has shown a fall of 50 per cent in the blood-pressure when ether was administered one-half hour; nitrous oxid and oxygen for the same period caused only a slight drop in pressure. Miles had an operative mortality of 36 per cent in 130 cases of abdominoperineal extirpation performed under ether and chloroform; whereas in a later series of fifty-three cases in which spinal anesthesia was combined with gas and oxygen, the operative mor-

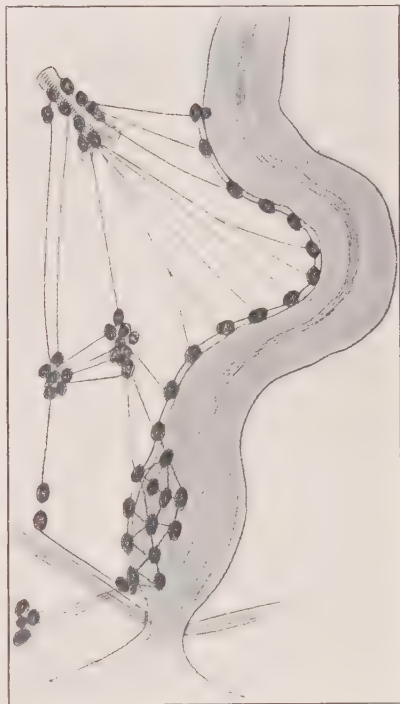


FIG. 350.—LYMPHATICS OF RECTUM.
(After Miles.)

tality was only 9.4 per cent. He very properly attributes this marked improvement largely to the employment of spinal anesthesia. Therefore, both animal experiments and clinical experience, dictate spinal or sacral anesthesia, supplemented as necessary by inhalation of gas and oxygen, as the anesthetic of choice for excision of the rectum.

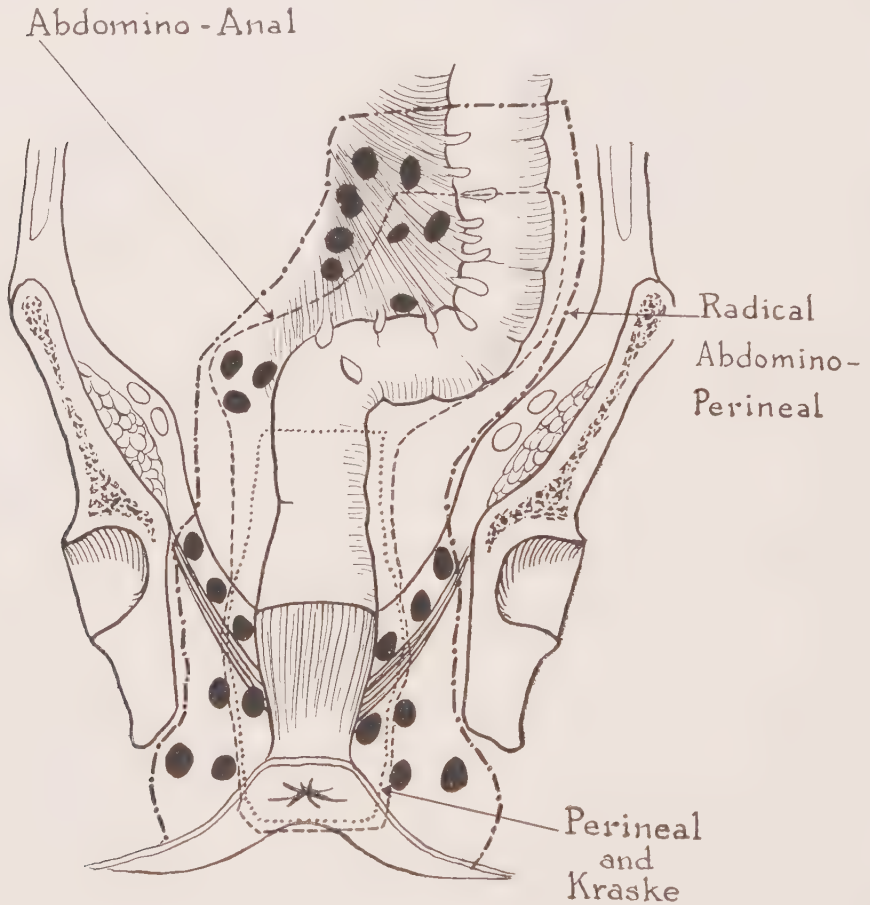


FIG. 351.—LYMPHATIC AREAS REMOVED IN VARIOUS TYPES OF OPERATION FOR CARCINOMA OF THE RECTUM. (Adapted from Miles.)

For perineal excision of anal and low rectal growths, transsacral anesthesia with caudal block is very satisfactory; but when the cancer involves the upper rectum or rectosigmoidal juncture, spinal anesthesia is essential. An additional advantage of this method is that it raises the operability age considerably above the sixtieth year, which is about the limit for general anesthesia.

The bone-flap operation is nearly obsolete, so its technic is omitted, as is that of vaginal resection, which is seldom used.

PERINEAL OPERATION*(Amputation of the Rectum)*

The skin over the perineum and sacral region is prepared the night before the operation by shaving and antiseptics and protected by sterile gauze. An enema of 25 per cent peroxid of hydrogen is given two hours before the operation. A hypodermic of $\frac{1}{4}$ grain morphin and $\frac{1}{150}$ grain atropin is administered one half hour before the time set for the operation.

Position of Patient.—The author prefers the lithotomy position with a slight Trendelenburg elevation of the table. If the patient be a male, a stiff

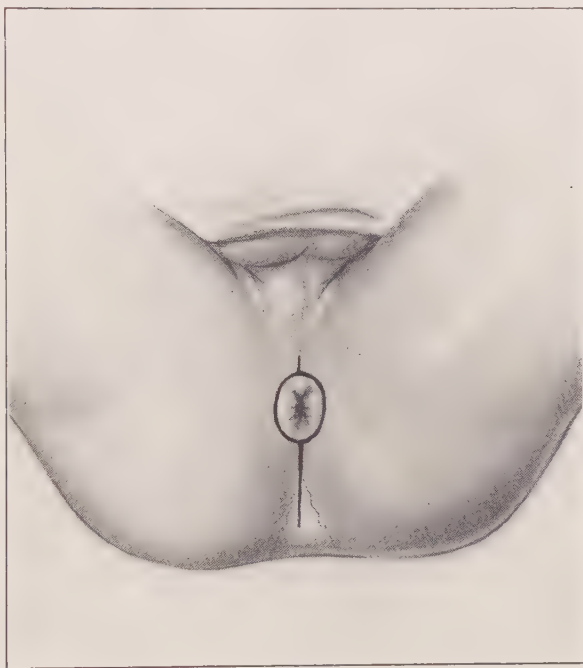


FIG. 352.—PERINEAL PROCTECTOMY: THE INCISION.

catheter is tied in the urethra to guard against its injury during the operation. This is unnecessary in women, but the vagina is swabbed with 5 per cent picric acid solution.

Technic.—The technic varies with the situation of the growth. If the anal canal is involved or the tumor is an epithelioma of the anus, the perianal skin must be removed widely and the sphincters sacrificed. If the lower margin of the growth is 1 inch or more above the anus, the external sphincter may be preserved.

Excision of Rectum with Preservation of Sphincters.—The rectum is sponged dry, swabbed with tincture of iodine, and then lightly packed with gauze

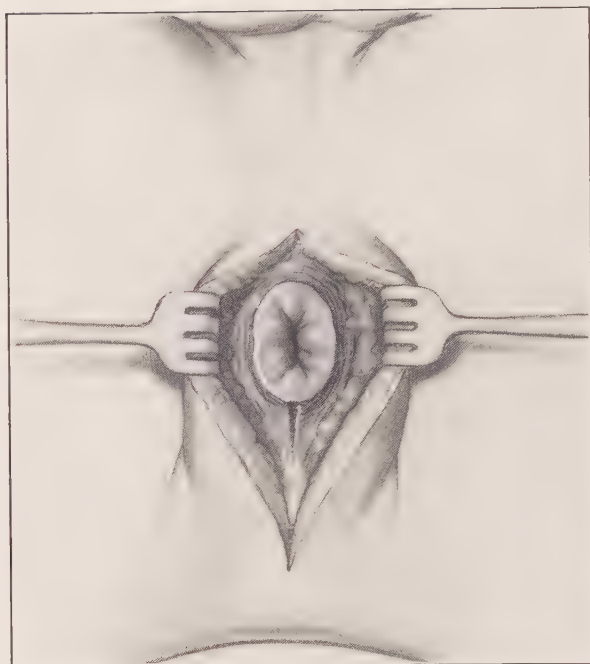


FIG. 353.—PERINEAL PROCTECTOMY: SECOND STEP.
External sphincter ani exposed and divided.

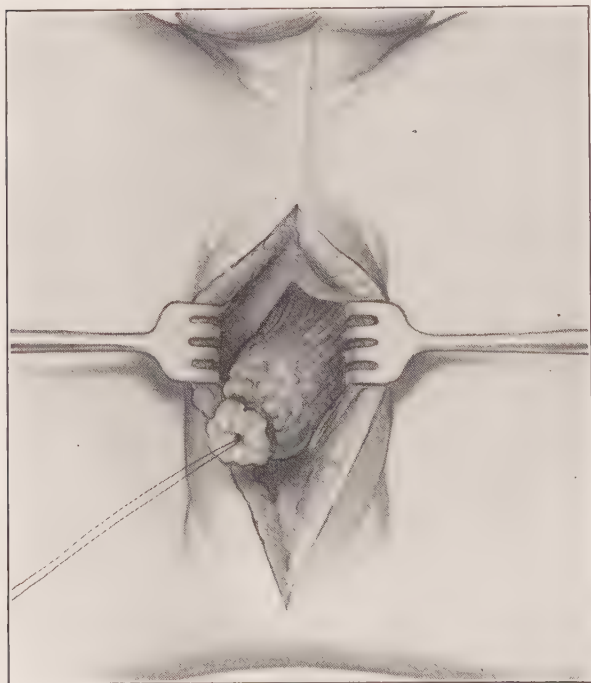


FIG. 354.—PERINEAL PROCTECTOMY.

Anus closed by a stout ligature which is used for traction. Rectum dissected free on all sides, exposing levator ani muscles.

in order to identify its walls during the dissection. A circular incision is made at the mucocutaneous junction of the anal canal; a cuff of mucosa is dissected up $\frac{1}{2}$ inch and closed with a heavy silk ligature to prevent fecal contamination of the wound. The long ends of the ligature serve for traction (Fig. 354). The cuff below the ligature is carbolyzed and gloves are changed. The external sphincter is freed from the bowel by blunt dissection and incised posteriorly

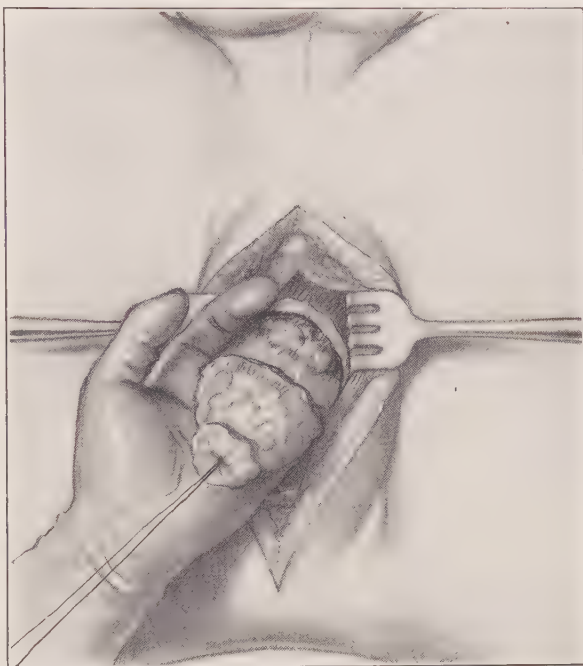


FIG. 355.—PERINEAL PROCTECTOMY.

Levator muscles divided close to rectum, and the rectum elevated from the sacral concavity. The rectum is being separated from the perineal raphé.

(also anteriorly if necessary) entirely outside the rectum and left in the lateral flaps.

The posterior incision is extended back in the midline to the base of the coccyx and deepened into the ischiorectal fossa. A pair of long, heavy scissors curved on the flat is passed between the rectum and levator ani muscle and withdrawn with the blades open. Then two fingers are introduced through this opening into the retrorectal space, bluntly clearing the anterior surface of coccyx and sacrum, crowding the tissues of the mesorectum forward toward the rectum. After severing the insertions of the glutei muscles at the sides of the coccyx, the bone is disarticulated. The finger is then hooked above the levator ani and its fascia and these structures on each side divided with scissors a short distance from the rectum. A long strip of full width gauze, folded to 4 inches, is packed tightly in the posterior space to stanch oozing of blood.

Blunt curved retractors are now placed to hold the anal sphincter and anterior margin of the wound forward; the rectum is drawn backward and dissected free anterior to the level of the severed levator ani. In women there is a plane of cleavage through which the rectum can be readily separated from the vagina by blunt dissection; in men, separation from the urethra, prostate, seminal vesicles and bladder is frequently difficult and requires extreme care to avoid injury of these organs. Sometimes separation can be accomplished

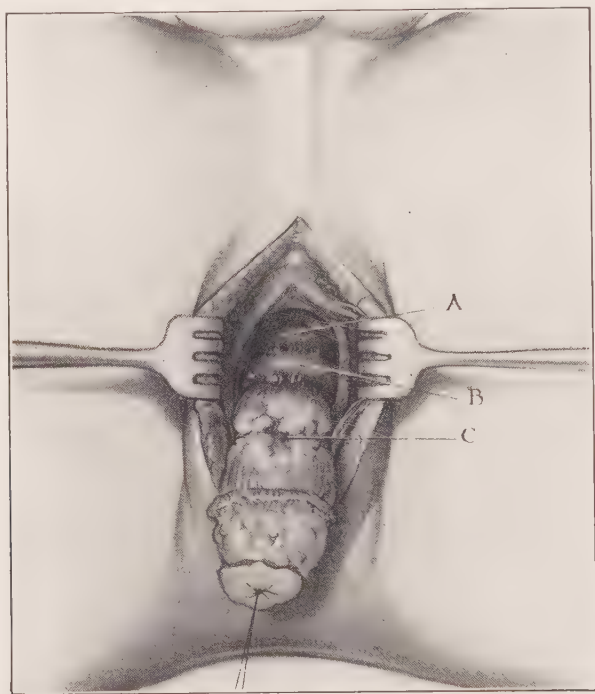


FIG. 356.—PERINEAL PROCTECTOMY.
A, prostate; B, peritoneal pouch; C, tumor.

easier by introducing the finger into the wound and separating the anterior rectal wall from above downward, severing the anobulbar raphé upon the finger.

The lower portion of the rectum is now free on all sides. Above it is still fixed by the lateral ligaments, peritoneum and the vessels in the mesorectum. The packing is removed and while making moderate traction on the rectum, its mesentery is readily peeled from the sacrum, as far as the peritoneal culdesac in front. Any firm fibrous bands encountered should not be torn through but caught in forceps and cut. The lateral ligaments are then identified by touch, doubly clamped on each side to control bleeding from the middle hemorrhoidal arteries and cut between the clamps. The gut can now be drawn down, exposing the peritoneal pouch. If the upper margin of the tumor protrudes 2 inches or

more beyond the surface of the wound, dissection of the rectum may end at this point.

If, however, as is usually the case, the growth approaches the area of the peritoneal pouch, the peritoneum can be peeled from the rectum for a short distance. Usually it is better to change gloves and instruments and divide the peritoneum close to the rectum back to the mesorectum. The latter is divided close to the sacrum to avoid injury of the inferior mesenteric artery. In this manner about 8 inches of bowel can be removed.

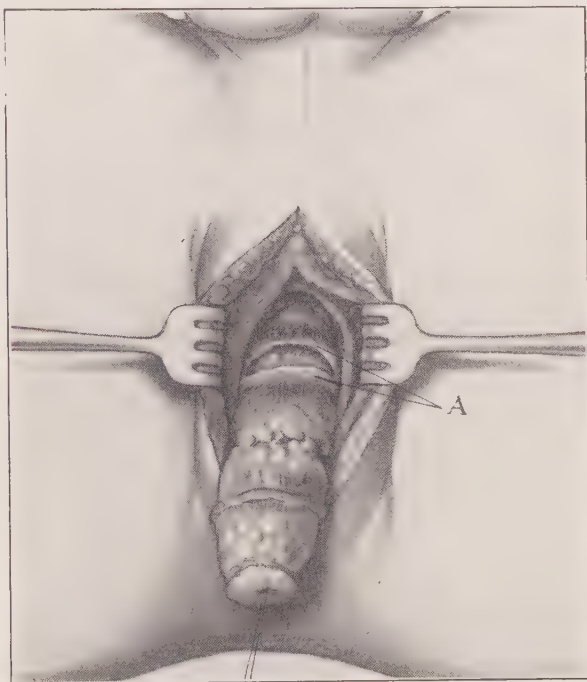


FIG. 357.—PERINEAL PROCTECTOMY.

A. Peritoneal pouch opened by a transverse incision, exposing pelvic colon.

When the length of freed bowel above the tumor is sufficient to reach the anus without tension, the peritoneum is closed by attaching it to the anterior and lateral walls of the rectum with interrupted sutures of fine chromic catgut. Any clamped vessels are now tied and the clamps removed. The levator is sutured to the sides of the bowel. A few interrupted sutures through the muscular coat of the bowel and the tissues above the sphincter close the anterior dead space. The sphincter (if it has been cut anteriorly) is sutured and the skin closed with silkworm gut. Then three Stewart sutures of the same material are passed transversely on a large curved needle just back of the protruding bowel.

These sutures are very important in restoring pelvic support. The needle is first passed deeply about 1 inch from the margin of the wound and brought out at a corresponding point on the opposite side, then in its return picks up the skin only of both sides in the same plane $\frac{1}{4}$ inch from the wound margin, and is tied snugly over a small rubber tube to avoid excess tension on the skin.

The bowel is now amputated $\frac{1}{4}$ inch outside the anus, the mucosa being caught in T-forceps as the incision is made. When the incision reaches the mesentery this is caught and tied, otherwise retracting vessels will bleed. As the bowel is divided some bleeding should occur. Absence of bleeding shows

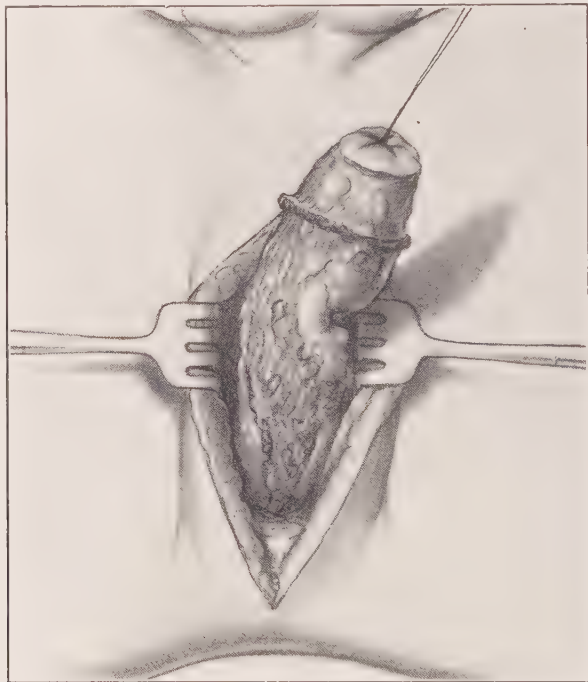


FIG. 358.—PERINEAL PROCTECTOMY: POSTERIOR DISSECTION CONTINUED.

Freed rectum drawn down and elevated over the perineum by traction, exposing its posterior raw surface between the peritoneal folds of the mesorectum.

inadequate blood supply and probability of the bowel sloughing. Careful note is also made that the line of amputation is well above the tumor. The mucosa is sutured to the skin with interrupted stitches and a tube inserted in the bowel, its lower end projecting 3 inches outside the external dressings to convey discharge and gas away from the wound.

Peck sutured the bowel all around at the skin margin, ligated the protruding gut 2 inches from the anus and amputated beyond the ligature, which was left on for forty-eight hours to prevent fecal contamination of the wound.

A large drainage tube is inserted into the cavity posterior to the rectum, and gauze packed lightly about it. Fluffed gauze covering the wound is held securely in place by strips of adhesive applied transversely across the buttocks, while the patient's legs are extended. Over this a large pad of gauze is placed and held in position by a broad T-binder.

Amputation of Rectum with Sacrifice of Sphincters.—When operating upon an epithelioma of the anus or a carcinoma involving the lower inch of the rectum, the anal canal, sphincters and a wide margin of adjacent tissues must be removed *en bloc*, together with the tumor-bearing portion of the rectum. The author has found a “shield” incision very practical.

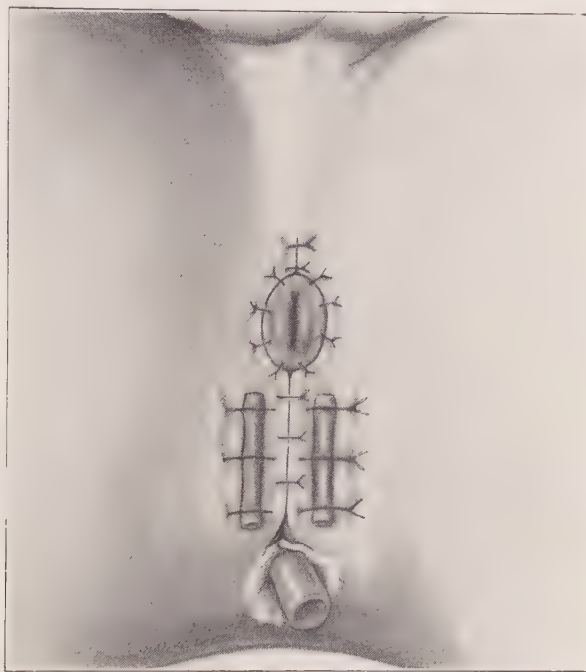


FIG. 359.—PERINEAL PROCTECTOMY: OPERATION COMPLETED.
For clarity, the tube in the rectum is omitted.

An incision of 3 to 4 inches is carried transversely across the perineum. From each of its ends, curvilinear incisions meet at the tip of the coccyx. This incision insures wide removal of skin, superficial fascia and lymphatics. The dissection is carried out as in the previous operation, but usually a shorter length of rectum requires removal. After the gut descends a sufficient distance, the pelvic floor is restored by suture, bowel amputated and rectal mucosa sutured to the skin.

Drainage tubes are inserted and dressings applied in the manner already described.

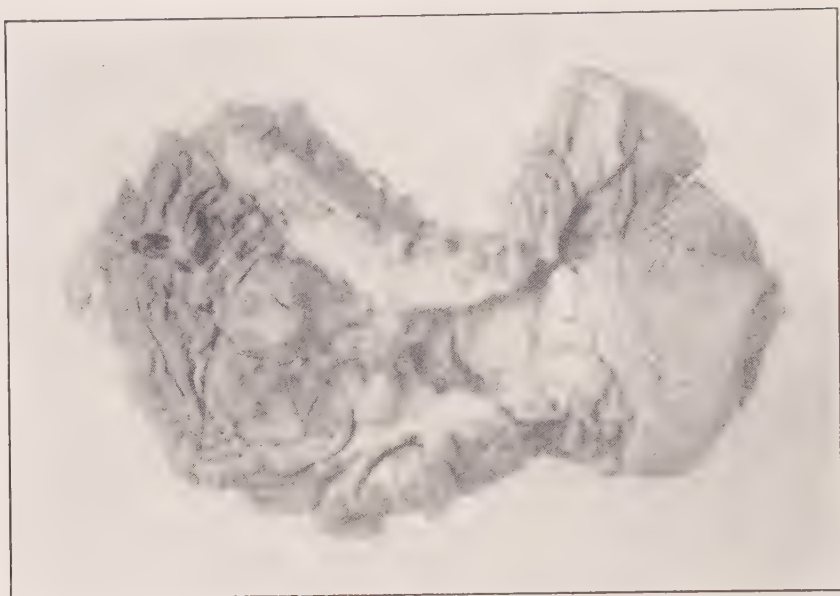


FIG. 360.—PHOTOGRAPH OF CARCINOMA OF RECTUM, PERINEAL EXCISION.
Male, aged forty-nine.

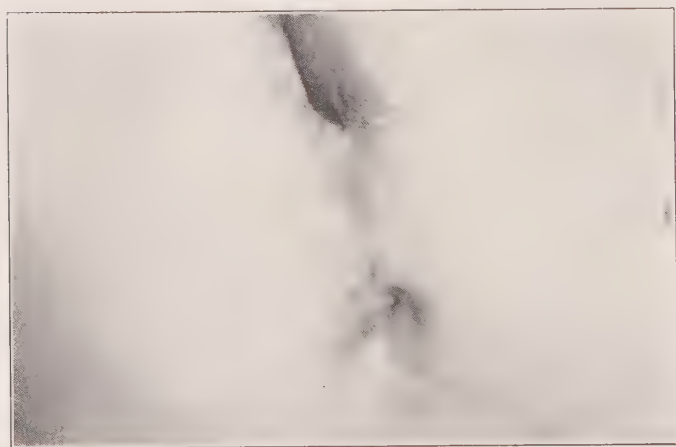


FIG. 361.—PERINEAL PROCTECTOMY.

Photograph of perineum one year after operation. Note firm scar. Colostomy preceded amputation. Same case as Fig. 360.

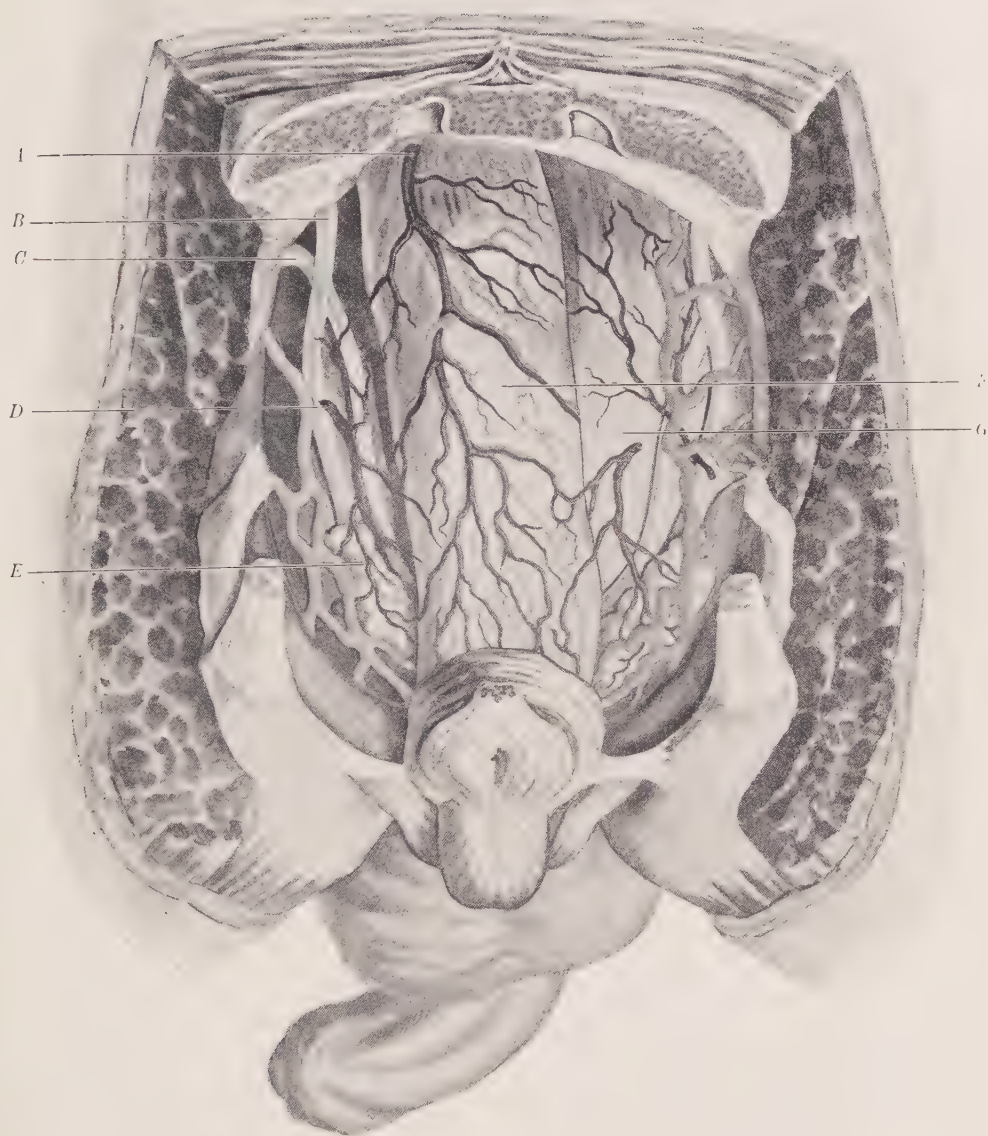


FIG. 362.—SACRUM REMOVED TO EXPOSE RECTUM AND OTHER PELVIC ORGANS (PARTLY SCHEMATIC).

A, superior hemorrhoidal artery; *B*, vas deferens; *C*, ureter; *D*, lateral sacral artery; *E*, seminal vesicles; *F*, rectum; *G*, bladder. (Cabot.)

POSTERIOR RESECTION

(Kraske's Operation)

This operation is employed for complete removal of cancers of the middle or upper third of the rectum, but not when the growth involves the rectosigmoidal area.

The preparation of the patient, anesthesia and tying a catheter into the bladder are the same as for the perineal operation. The first step in the operation is to close the anus tightly by a purse-string linen suture, as advised by Kocher, to prevent fecal contamination of the wound.

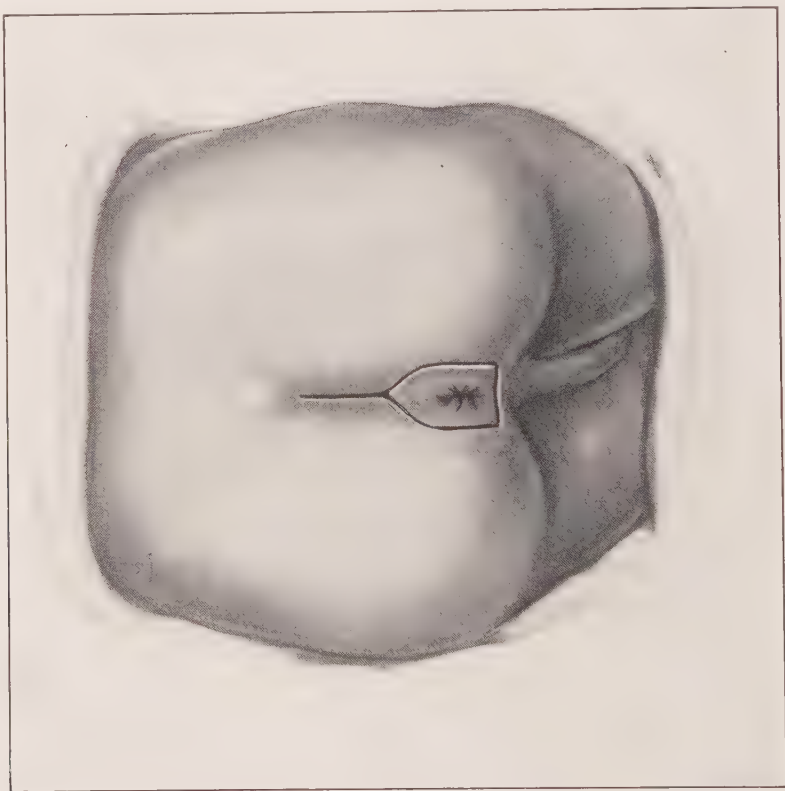


FIG. 363.—POSTERIOR EXCISION OF RECTUM: THE INCISION.

With the patient in the left lateral position an incision is made from the sacrococcygeal joint to the external sphincter. The coccyx is disarticulated; the wound deepened; the deep fascia opened in front of the sacrum; and the fingers separate the bowel from the sacrum up to the promontory. The left index finger is hooked above the left levator ani which is now cut some distance from the rectum. The right levator is divided in the same manner. The rectum

is further isolated by dissection on each side until the portion between the levator ani and peritoneal reflection is freed on all sides. A strip of gauze passed about the rectum at this point serves as a retractor while the bowel is separated from its close anterior attachments to the prostate and seminal vesicles, or the vagina.

The rectum is drawn into the wound and freed until sound bowel reaches the sound segment below the growth without tension, or until it reaches the

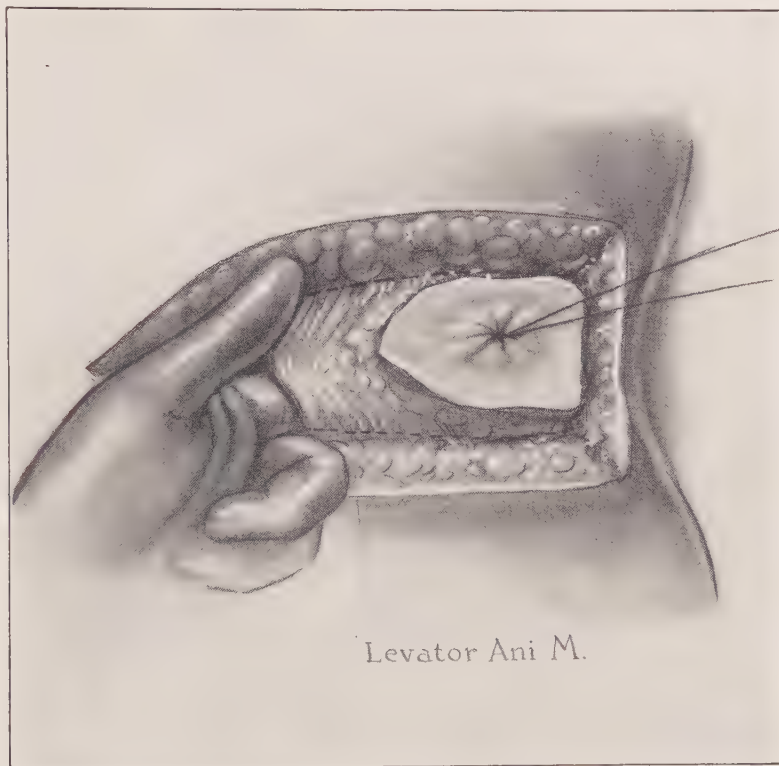


FIG. 364.—POSTERIOR EXCISION.

Exposure and division of the levator muscles on each side close to the pelvis.

anus. When this fails, the peritoneum is opened and cut close to the rectum on each side to avoid injury of the ureters. The lateral ligaments and mesorectum are severed close to the sacrum to avoid injury of the superior hemorrhoidal artery and to remove the sacral lymph-nodes. When a sufficient length of bowel has been liberated, the peritoneum is closed by uniting it to bowel serosa with interrupted sutures to prevent infection of the abdominal cavity and intestinal hernia.

The bowel is now doubly ligated with strong tape or clamped 1 inch or more above the tumor and the bowel divided with cautery between the clamps.

Another pair of clamps is applied similarly below the growth and the malignant segment extirpated.

If 1 inch of healthy rectum remains above the anus, the proximal and distal segments are joined by suture in an end-to-end anastomosis. When less than 1 inch of healthy rectum remains above the anus after excision of the tumor and the gut can be brought down to the anus without tension, the "pull-through" method of Hochenegg is employed. The purse-string suture is removed;

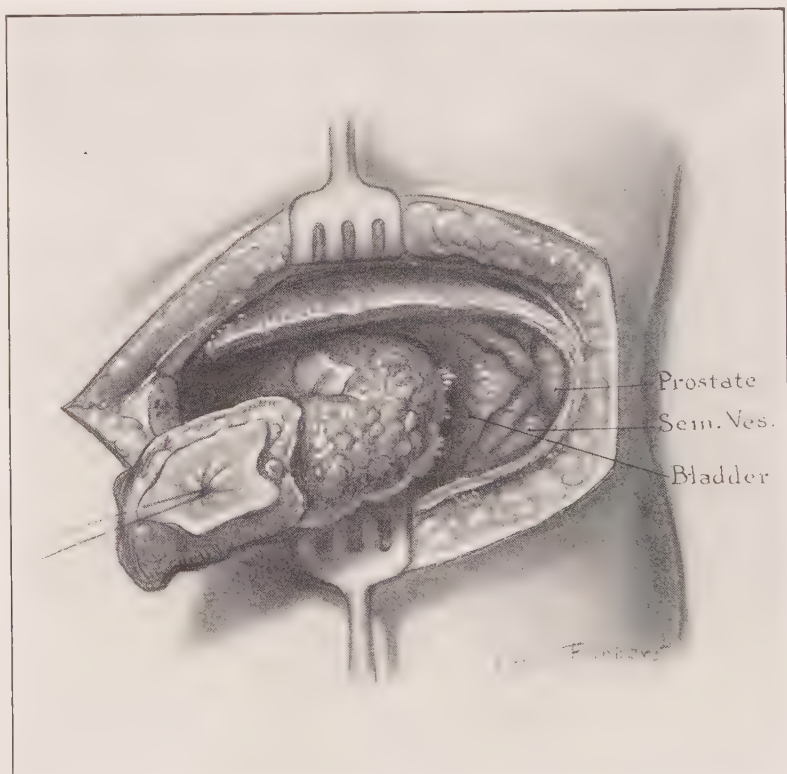


FIG. 365.—POSTERIOR EXCISION.

Dissection of bowel from the structures anterior to it—prostate, seminal vesicles and bladder.

sphincter dilated; the lining of the anal canal excised; the ligated proximal end of bowel drawn through the anus and sutured to the skin margin. The ligature is removed at the end of forty-eight hours unless gas pressure necessitates opening of the bowel earlier.

In some instances, where the proximal bowel cannot be drawn down sufficiently for end-to-end anastomosis or implantation in the anus, it is sutured in the upper angle of the wound, forming a sacral anus, which is much less satisfactory than an incontinent anus at the normal site.

The levator ani muscles are sutured to the new rectum; the bowel sup-

ported as much as possible by buried chromic sutures and the wound closed by deep interrupted silkworm gut sutures, passed deeply, except at its lower end where a cigarette-drain is inserted. The catheter is removed, a drainage tube inserted into the rectum above the point of anastomosis, and a large fluffed gauze dressing applied externally. When the length of apparently healthy gut above the tumor can be easily brought down through the anus, the "pull-through" procedure of Hochenegg is the preferable method of preserving the sphincter.

Other methods of preserving the anal sphincters have been practiced. Maunsell and Weir prolapsed the gut and growth through the anus, resected the bowel and performed anastomosis by through-and-through sutures. Perron, after posterior resection of the growth, everted the rectal stump, drew the proximal end through the anus and united the ends by suture. After continuity of bowel was established, the anastomosis was reduced through the anus.

Comment.—As the anal stump possesses no peritoneal covering, end-to-end anastomosis is usually followed by non-union, posterior fecal fistula and later by stricture at the line of suture.

The danger inherent in all these methods designed to preserve the sphincter is that resection is too restricted; continence is too frequently purchased at the price of early recurrence. For these reasons all methods which, after resection, aim to establish bowel continuity between segments devoid of serosa are so apt to result in failure that they are seldom practiced.

COMPLETE POSTERIOR EXCISION WITH COLOSTOMY

Instead of the Kraske, for cancers of the middle and upper rectum, not suitable for perineal extirpation, the present practice is to establish a permanent colostomy and do a complete posterior excision of the rectum and anus. A properly performed colostomy through the left rectus muscle usually functions well and causes the patient far less inconvenience than is commonly supposed.

If feasible, operation at one stage is preferable and more satisfactory than in two or more stages. When there is some degree of obstruction or the patient is debilitated, it is best to allow an interval of ten days or two weeks between the colostomy and the major excision. Meanwhile colonic contents passed through the functioning stoma relieve stasis toxemia; the segment of bowel distant to the opening is rendered less septic by daily irrigations; and forced feeding until the day of operation increases the patient's strength.

Technic.—The preliminary steps are as given under *Excision of the Rectum with Preservation of the Sphincter*: Tight closure of the anus with a purse-string suture, tying a catheter into the urethra in men, etc. Local anesthesia is used for the colostomy; spinal, supplemented by gas-oxygen, for the excision.

The left semiprone position is preferable. Some surgeons use an exaggerated lithotomy position which gives a better view but blood is more liable to enter the peritoneal cavity when it is opened.

The incision extends in the midline from the sacrococcygeal joint to 1 inch

back of the anus, where it divides and surrounds the anus at this distance. The incision is deepened extending widely into the ischiorectal fossæ. The coccyx is disarticulated, and a short transverse incision is made in the deep fascia just in front of the sacrum. Through this opening the index finger is passed into the cellular space between the peritoneum above and the levator ani muscle below. The finger is hooked above the levator and its fascia on the left side and these structures are severed by scissors wide from the rectum. The right

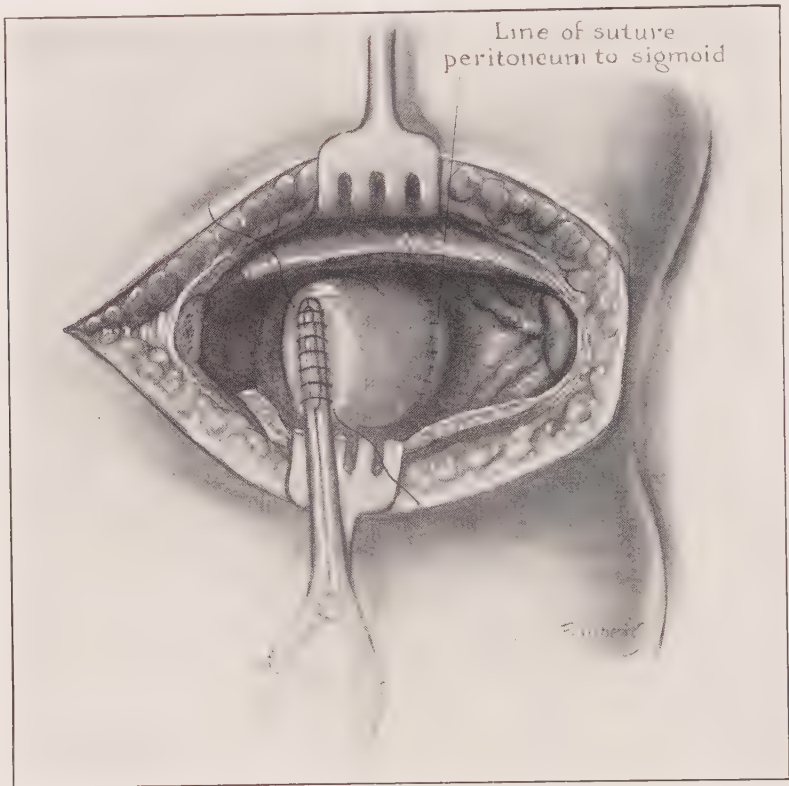


FIG. 366.—POSTERIOR EXCISION.

Rectum has been excised. Peritoneum sutured to sigmoid. Suture applied over clamp closing proximal end of bowel.

half of the levator is then cut in the same way. The rectum is next liberated in front from the prostate and seminal vesicles or the vagina, carrying the dissection close to these organs. Separation of the rectum from the vagina with scissors and by blunt dissection is comparatively easy, but great care must be exercised in freeing it from the prostate, as the bowel may be opened with resultant infection of the wound. The catheter in the urethra is a valuable guide in this part of the dissection.

Next, the dissection in front of the anus is carried up 2 or 3 inches until

the apex of the prostate is exposed. The rectum is now readily separated to the peritoneum which is opened and cut close to the bowel to avoid injury of the ureter, and continued back to the mesorectum. The latter is clamped high and cut, and its vessels tied. The bowel is divided by cautery between double clamps applied well above the growth. The proximal end is invaginated and closed by a Mikulicz stitch applied over the clamp. Closure of the peritoneum is effected by a continuous suture of the peritoneum around the sigmoid stump. No gap



FIG. 367.—POSTERIOR EXCISION.
Appearance of wound after dissection is completed and suture tied.

should be left through which a knuckle of small intestine may descend and become strangulated as has occurred in some cases where closure was not accurate.

The wound is closed in part at each end. Through the unsutured portion a square of rubber dam is inserted and packed with gauze against the sides of the wound. Fluffed gauze applied over the wound is supported by transverse adhesive strips and a T-binder.

Unless the bowel is accidentally opened during the operation, the entire rectum and anus is excised aseptically. For this reason Mummery closes the wound

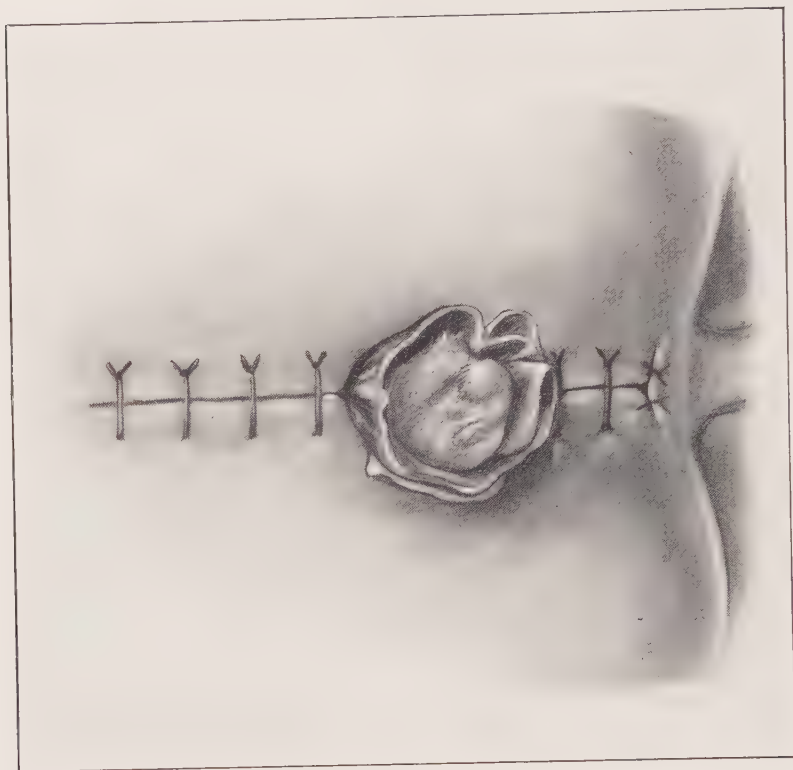


FIG. 368.—POSTERIOR EXCISION.

Wound partly closed at each end. The cavity, lined with rubber dam, is packed with gauze.

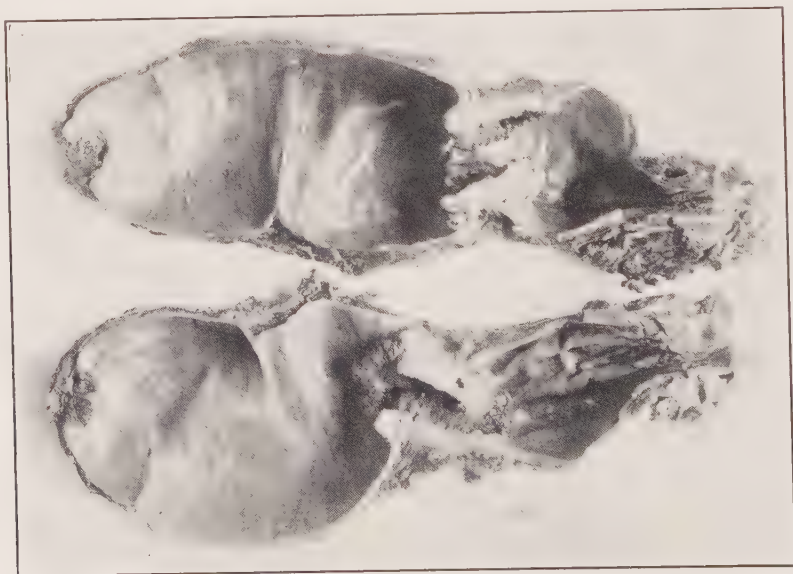


FIG. 369.—SPECIMEN REMOVED BY POSTERIOR EXCISION.
Rectum and anus laid open exposing the carcinoma.

completely with drainage. If the posterior vaginal wall is involved it may be included in the dissection of the rectum.

Postoperative Treatment.—Usually shock and pain are not marked after perineal or posterior excision of the rectum. If a permanent colostomy was established, a light diet is begun on the second day. In the perineal operation, the bowels are confined from five to seven days, by giving fluids without milk. Evacuation is then had by injecting olive oil through the rectal tube, followed in two hours by a soapsuds enema, and the tube is removed.

The external dressings are changed twice daily or oftener if soiled. The posterior drains are removed on the third or fourth day, the wound irrigated with 2 per cent boric acid or 1:10,000 permanganate solution. Vaseline gauze drains are then introduced and the wound irrigated daily when they are changed. The stitches are removed between the sixth to the eighth day.

The patient is encouraged to sit in a chair in ten days to two weeks and generally can return home by the end of the third or fourth week.

ABDOMINOPERINEAL EXCISION

(The Combined Operation)

When the cancer involves the rectosigmoidal zone, the combined operation is the only feasible procedure. Indeed, it would be the ideal operation for all rectal cancers were it not that its mortality rate is unfortunately higher than in the more restricted perineal and sacral operations. By it, the conditions within the abdomen can be directly ascertained and wider areas of involved tissue removed.

It is an operation of great magnitude which must be applied when the cancer cannot be removed completely by the posterior route or through the abdomen alone.

The combined operation consists in freeing the gut of its attachments within the abdomen, closure of the pelvic peritoneal floor, and removal of the growth by either the perineal or sacral method after closing the abdomen.

Anesthesia.—Spinal anesthesia is used. As this wears off in about one hour, it is supplemented by injecting 1 ounce of 2 per cent novocain solution into the sacral canal (caudal block). The latter anesthetizes the perineal region two hours or longer and is efficient for the perineal dissection. Gas-oxygen is administered, as necessary, during the abdominal portion of the operation.

Technic.—High Trendelenburg *position*.

Incision.—Right paramedial, $\frac{1}{2}$ inch from the midline, and extending from pubes to 1 inch above the navel. Sheath of right rectus is opened the length of the wound, the muscle retracted outward and the peritoneum incised longitudinally.

A self-retaining abdominal retractor with three blades gives adequate exposure to examine by sight and touch, the extent of bowel involvement, implication of the bladder or vagina, and metastases to the mesentery, peritoneum or liver. Hepatic, vesical or vaginal involvement preclude radical excision;

mesenteric may not. If the case is deemed operable, the wound margins are protected by towels held by clips and the small intestine is retained in the upper abdomen by a large laparotomy pad. The sigmoid is held taut in the wound and the peritoneum is incised on each side of the parietal mesenteric attachment, parallel to the gut, from the sigmoid artery to the peritoneal reflection. Peri-

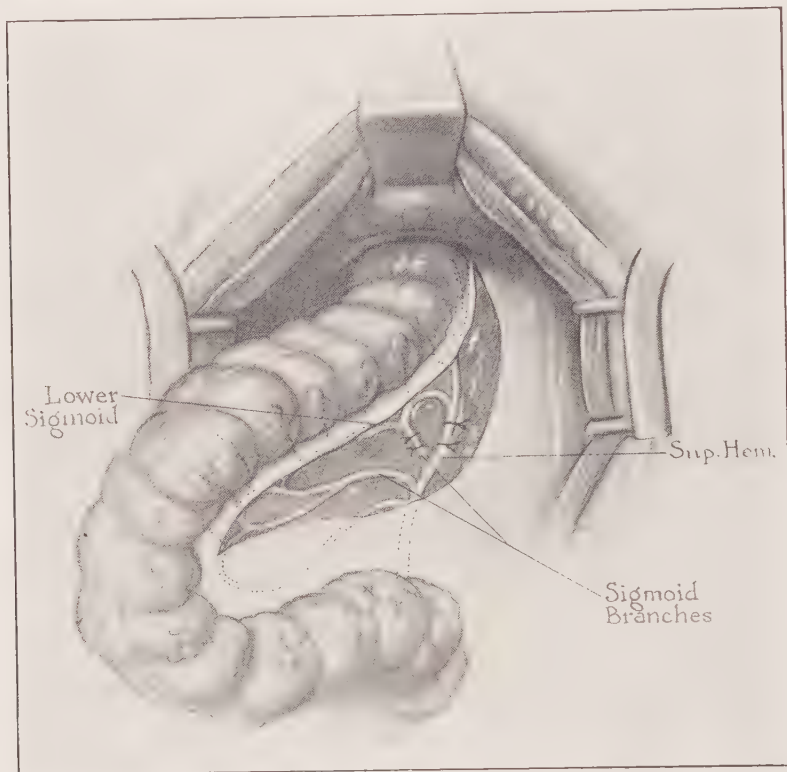


FIG. 370.—ABDOMINOPERINEAL EXCISION OF RECTUM.

Inner peritoneal leaf of mesosigmoid incised, exposing the blood-vessels. If continuity of the bowel is to be preserved, the superior hemorrhoidal vessels are doubly ligated just below the sacral promontory and cut between the ligatures. If a permanent colostomy is made, the inferior mesenteric artery and veins are divided between ligatures opposite the bifurcation of the aorta.

toneal incision is best accomplished by a pair of long-handled scissors curved on the flat, care being taken to avoid the ureter on the left side.

The inferior mesenteric artery is now identified and a ligature on an aneurysm needle is passed around the artery and its veins, opposite the bifurcation of the aorta. A second ligature is applied $\frac{3}{4}$ inch lower and the vessels are cut. By placing the ligatures at the "point of election," the anastomotic loops supplying the pelvic colon and upper rectum are preserved. If continuity of the bowel is to be preserved, it is essential to place the ligature proximal to the "critical point" of the superior hemorrhoidal artery which is at its junction with

the lower large anastomotic sigmoidal branch. When a permanent colostomy is to be made, it is safe to ligate the inferior mesenteric artery immediately below the point where the left colic artery is given off. At the same time an almost bloodless field is secured for the rest of the operation and danger of including the left ureter in the ligature is avoided. The pelvic mesocolon is cut and the rectum together with its mesentery and glands can now be stripped readily by the hand from the sacrum, as far as its lower border where the rectal fascia



FIG. 371.—ABDOMINOPERINEAL EXCISION.

Peritoneal incisions on each side of bowel are united below by an incision across the bottom of the peritoneal pouch. Rectum being elevated from hollow of the sacrum.

is firmly attached to the periosteum. Gauze is packed into the postrectal space and the peritoneal incisions are continued around in front of the rectum at the peritoneal reflection. After finding the anterior line of cleavage, the rectum is separated from the uterus and vagina, or in the male from the bladder down to the prostate. All that remains to isolate the rectum is to divide its lateral ligaments on each side as far as the levator muscle, carefully avoiding the left ureter. A ligature may be required to control the contained middle hemorrhoidal artery. Failure to cut these ligaments hampers mobilization of the gut from below.

When this stage of the operation is reached, the surgeon must choose one of two procedures: (a) Preservation of the continuity of the bowel by completely mobilizing the remaining rectum from below; amputation of the bowel above the tumor, and suture of the sigmoid to the anus; or (b) establish a permanent colostomy and remove all of the bowel^{*} distal to the stoma together with surrounding fat and glands. In recent years, the latter procedure has gained favor, and justly. By it the most radical excision is accomplished whereby the chance

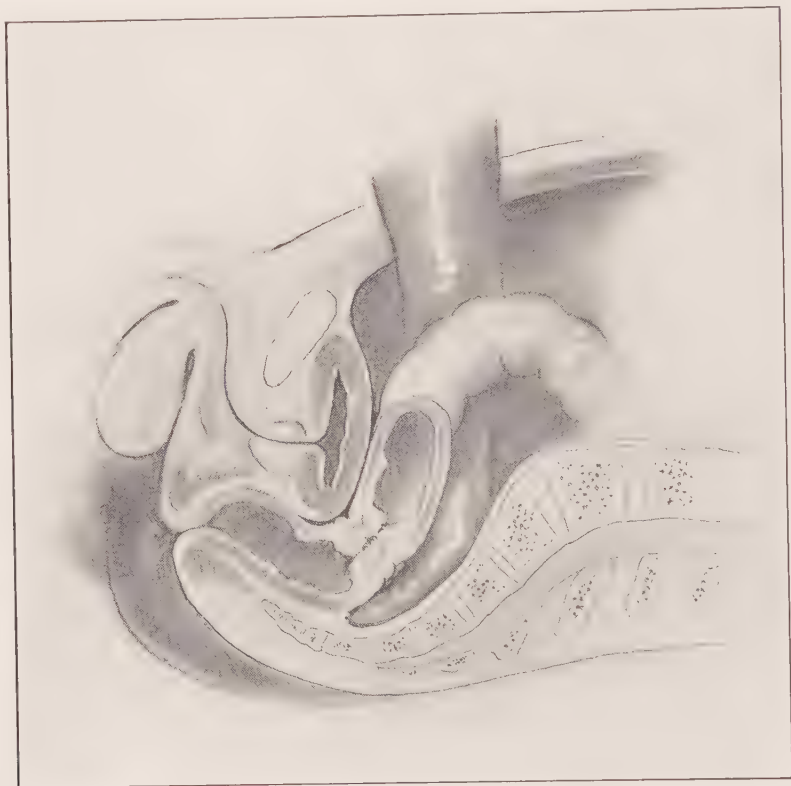


FIG. 372.—ABDOMINOPERINEAL EXCISION.
Posterior dissection made down to coccyx. (Diagrammatic.)

of recurrence is minimized which more than compensates for the inconvenience of the artificial anus.

On the other hand, when the continuity of the bowel is preserved, the patient generally has fairly good control of the anus in the normal position. In this procedure, after the rectum is isolated from above, the surgeon must decide the vital point, whether a sufficient length of bowel with intact blood supply can be brought down to the anus without tension. Inadequate blood supply will result in gangrene and slough of the bowel. For these reasons the choice of operation cannot be determined before the abdomen is opened. If there is the

least doubt that the sigmoid cannot be attached to the anus successfully, permanent colostomy should be established without hesitation.

Preliminary colostomy is not desirable in the combined operation but is indicated when the tumor obstructs the bowel to such a degree that it cannot be emptied by cathartics and irrigations. In that event, the proximal end of the divided sigmoid is used for the colostomy while the distal end, inverted and closed by a Mikulicz stitch, is dropped back into the abdomen.

If permanent colostomy is elected, the sigmoid is isolated with pads, and divided between clamps at or below its center with a cautery, which sterilizes and seals the severed ends. Closure is fortified by applying a Mikulicz stitch over each clamp. Gloves are changed. If the tumor is small, the distal closed end of the bowel is carried deep into the presacral space and the remainder of it crowded down below the level of the pelvic peritoneum. If the tumor is large and double forceps can be placed below it, the subsequent steps of the operation are greatly facilitated by dividing the bowel between right-angled clamps, so applied, and removing the growth through the abdomen. The distal end is tied and the crushed stump sterilized.

The opening in the pelvic peritoneum is closed by a continuous chromic gut suture. Unless closure is complete, dangerous hernia of the small intestine may occur. Owing to the large amount of peritoneum removed a gap frequently remains. If the large peritoneal opening cannot be closed without undue tension, the gap may be bridged over by raising a flap of peritoneum from the bladder in men, or in women, by retroverting and sewing the uterus over the defect.

A permanent colostomy is next established by drawing the proximal end of sigmoid through a short vertical incision at the outer third of the left rectus muscle, just below the level of the umbilicus, or through a gridiron incision 2 inches inside and 1 inch above the left anterior superior spine. The opening should be only large enough to admit the bowel without constricting its blood supply. The bowel is drawn out of the wound 2 inches or more, and fixed by a suture at the angles of the wound. The table is lowered to the horizontal. The abdomen is closed without drainage and the wound protected by a layer of gauze covered by rubber protective sealed at its margins with collodion. A temporary dressing is applied.

Then, with the patient in left semiprone position and hips at the edge of the table, the operation is completed according to the technic already given for complete posterior excision of the rectum.

The tissues removed *en bloc* comprise a segment of bowel 12 to 16 inches in length (isolated pelvic colon, rectum, and anus) levator ani muscles and fascia, the mesorectum with its contained glands and most of the fat in the ischiorectal fossæ and retrorectal space.

The wound is partly closed at each end and the large cavity lined with a square of rubber dam into which gauze is packed to support the pelvic diaphragm. Dressings applied over this are retained by adhesive strips. The ab-

dominal wounds are dressed separately. If deemed necessary, the protruding bowel may now be opened by removing the suture and a rubber tube inserted 4 to 6 inches into its lumen around which the gut is tied with a tape. It is preferable, however, not to open the colostomy until forty-eight hours have elapsed.

Combined Operation with Preservation of Continuity of Bowel.—Owing to the possibility of the bowel sloughing when it is brought down to the anus be-

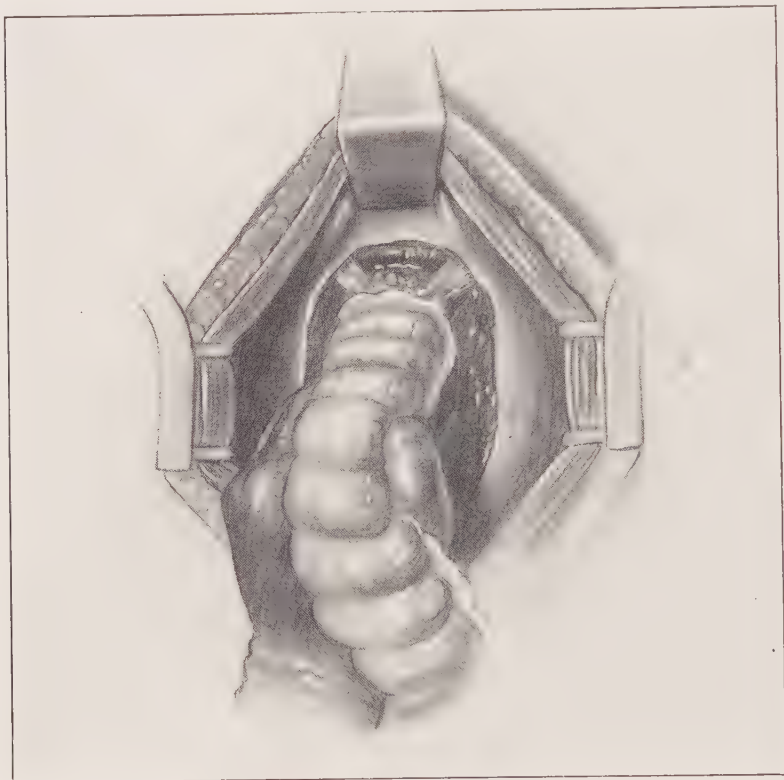


FIG. 373.—ABDOMINOPERINEAL EXCISION.
Lateral ligaments of rectum exposed.

cause of traction cutting off its already impaired blood supply, this method is at present seldom used. However, when the growth is small, and the sigmoid loop long and has a mesentery 5 or more inches in length at its center, the colon may occasionally be implanted successfully in the anus.

After exposure of the pelvis through the abdominal incision, the peritoneum at the base of the sigmoid is cut on each side with scissors and the peritoneal incision continued around the front of the bowel at the bottom of the culdesac. The superior hemorrhoidal artery is divided between double ligatures, 2 cm. below the promontory of the sacrum, *i.e.*, just above the last anastomotic loop

of lower sigmoid with the superior hemorrhoidal artery. The pelvic colon and rectum are isolated on all sides as far as the levator ani and the bowel crowded down into the presacral space. The pelvic diaphragm is restored by suturing the cut peritoneum as high as possible around the sigmoid. The abdominal wound is closed in layers and without drainage.

The second stage of the operation is carried out with the patient in the lateral position. After dilating the sphincter slightly, the anus is closed by a

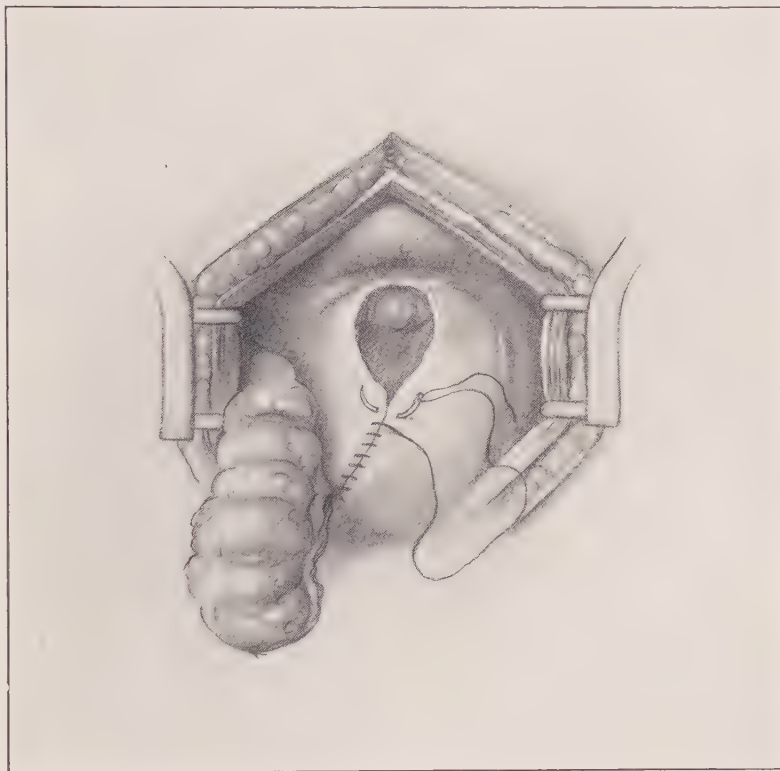


FIG. 374.—ABDOMINOPERINEAL EXCISION.

Distal closed segment of bowel depressed beneath peritoneum which is being closed over it with a continuous suture.

purse-string suture at the anal verge. A circular incision is carried about the anus just outside the suture and the lining of the anal canal is dissected free. Next, the entire rectum is dissected out through a median incision extending from the sacrococcygeal joint to the posterior margin of the anus, preserving the sphincter. The liberated bowel is drawn through the denuded anal canal, amputated at a liberal distance above the tumor and united to the skin by interrupted sutures. A drainage tube is inserted into the bowel and another tube with gauze packed around it, in the posterior wound which is partly closed at each end with deep sutures of silkworm gut.

Eversion Method.—Another procedure to obtain continuity without disturbing the sphincter is, after resection, to evert the rectal stump by grasping its margins with forceps passed through the anus and drawing the sigmoid end through after it; or, if the tumor is small, to prolapse the unopened bowel through the anus, amputate it circularly and establish continuity by through-and-through interrupted sutures of chromic gut. The line of anastomosis is reduced and a tube inserted a distance of 4 or 5 inches into the bowel.



FIG. 375.—ABDOMINOPERINEAL EXCISION.

Proximal end of bowel brought out through a separate wound for permanent colostomy. Abdominal incision sutured.

These methods are suitable only for selected cases of small growths in a high situation. Circular enteropathy seldom heals completely *per primam*, as the proximal segment only has a peritoneal investment, and a fibrous constriction always marks the site of suture. Their great advantage is that a functioning anus is preserved. In two cases in which the author employed the eversion method five years ago, the anatomic and functional results have been most satisfactory.

Coffey's Method.—Coffey has developed a two-stage abdominoperineal operation which rivals the one-stage operation of Miles in radical removal

of the cancer and its lymphatic extensions. Coffey removes the same organs and tissues as Miles by essentially the same technic, except that the operation



FIG. 376.—ABDOMINOPERINEAL EXCISION.

Photograph showing length of bowel removed by combined operation—anal canal, rectum with tumor and pelvic colon—14 inches. Male, aged fifty-five years.

is divided into two stages and an ingenious method of “quarantine drainage” is established during the interval.

The successive steps of the first stage are:

1. Long right rectus incision.
2. Division of superior hemorrhoidal vessels after ligation.
3. Mobilization of lower sigmoid and rectum.

4. Dividing sigmoid by cautery between clamps and drawing proximal leg through stab wound in left rectus for colostomy.

5. Rubber tube passed up through rectum and sigmoid to clamp; distal loop inverted and closed by a purse-string suture placed below clamp; end of tube attached to inverted gut by a linen suture passed through bowel wall and eye of tube; traction on tube which draws inverted sigmoid and rectum out through the anus.

6. Closure of the raw surfaces and formation, in the male, of an extra-abdominal peritoneal canal, for drainage through the lower angle of the abdominal incision.

In the female, after suturing the peritoneal and abdominal wounds, drainage is effected through an incision in the posterior vaginal fornix.

When the tumor is situated high and so large that the bowel cannot be inverted, the gut is cut between double clamps, applied below the growth, the

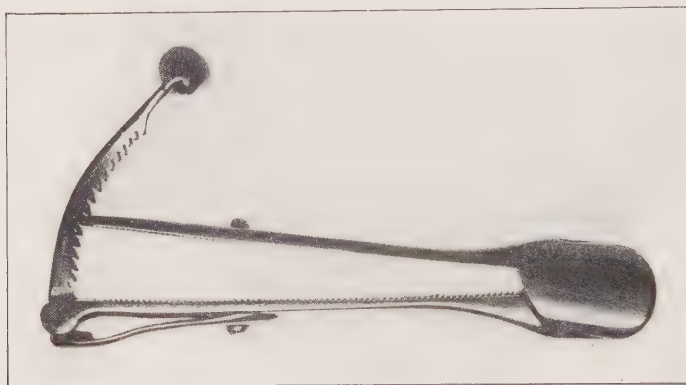


FIG. 377.—DUDLEY SMITH'S INTESTINAL CLAMP.

neoplasm removed and the clamp on the distal stump of the rectum is left protruding from the peritoneal drainage canal together with the large cigarette-drain, which both drains and acts as a "separating quarantine."

The *second stage* of the operation is performed about ten days after the first when "a complete anatomical and physiological abdominal mechanism has been reestablished." With the patient in the lateral or prone position, the rectum, anus, and surrounding muscles and fat are excised through a posterior median incision which surrounds the anus, using the technic already given for posterior excision of the rectum. The wound is not sutured. The large cavity is packed with gauze which is removed in four days. Thereafter the wound is irrigated and drained. The patient is allowed up in about two weeks but several weeks longer are required before the cavity closes by granulation.

This is a long operation, requiring much sewing in the first stage, but is very effective in preventing infection of the abdominal cavity. Dudley Smith of San Francisco has shortened the time of the first stage by clamping the

rectum at the end of the fourth step with a specially devised clamp without handles (Fig. 371), either above or below the growth, depending upon its location; clamping the gut just above with a right-angled clamp; severing the bowel with cautery between the clamps, thus freeing the mobilized rectum and sigmoid. Then two large rubber tubes are drawn from within outward through a stab wound alongside the coccyx for drainage; a quarantine gauze pack is placed over the rectal stump and above this is a piece of rubber dam over

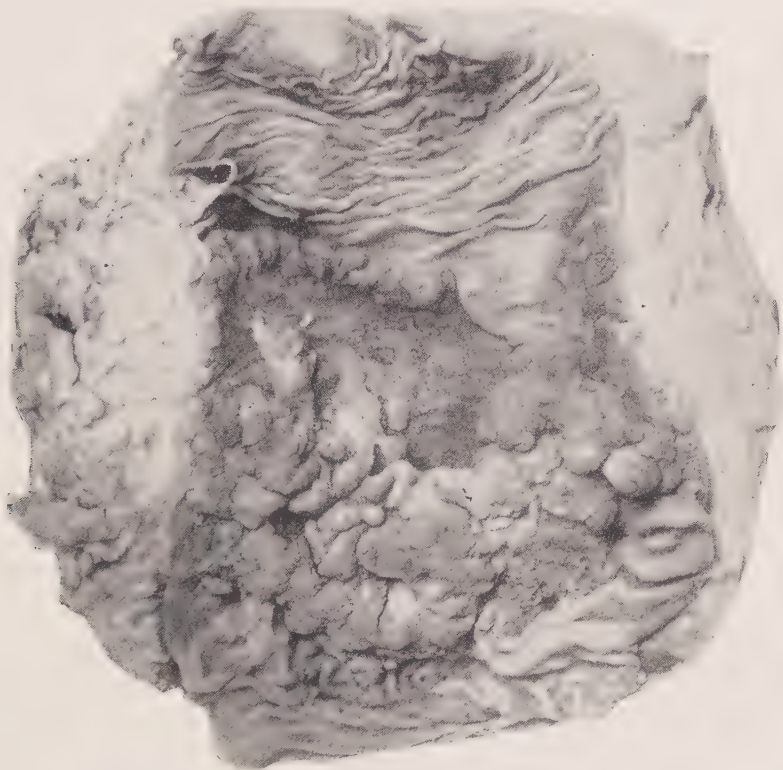


FIG. 378.—ADENOCARCINOMA OF RECTOSIGMOID, REMOVED BY COFFEY'S METHOD. Male patient, aged fifty-two, well over three and one-half years after operation.

which the peritoneum is sewed. The clamp is left in the pelvis to be removed with the rectum at the second stage of the operation.

Coffey operated upon forty-seven patients by his method with only two deaths.

The author used the Coffey technic in the following case:

Mr. H., aged fifty-two, following constipation of several weeks' duration, had for one year, frequent uncontrollable bowel evacuations, with progressive loss of weight and strength. About $3\frac{1}{2}$ inches above the anus, a large tumor was felt on the anterior rectal wall, typically carcinomatous in character. The growth

involved the rectosigmoid above. On June 8, 1925, the first stage of the Coffey operation was done and the tumor removed through the abdomen (Fig. 378). The second stage perineal excision was performed twelve days later. Convalescence was slow but the patient eventually made a good recovery. Now, over three years after operation, he is in excellent health. His colostomy functions well, gain in weight is 40 pounds, the highest it has ever been, and he pursues his usual occupation without discomfort.

Postoperative Treatment.—As the combined operation is usually attended by moderate to severe shock, measures to combat it are taken immediately, as external heat, intravenous digifolin, blood transfusion, gastric lavage for emesis and any other indicated procedures. Unless contra-indicated, the bowels are confined for five to seven days, during which the diet is fluids without milk. The patient is allowed up as soon as the abdominal wound is firm—two to three weeks. The perineal wound is dressed as in complete posterior excision of the rectum. Six weeks to three months are required for cicatrization of the perineal wound.

EXCISION OF CARCINOMA OF THE SIGMOID

When the cancer is situated in the lower sigmoid, so that after division of the bowel at a safe distance below the growth, only $\frac{1}{2}$ inch or less of the distal end, covered by peritoneum, is too short for an ordinary end-to-end anastomosis, either of two procedures is available:

1. Resection of the bowel, permanent colostomy with the proximal end, inversion and closure of the distal end by suture.
2. Tube resection as described by Balfour.

Tube Resection.—Under favorable conditions—absence of obstruction, and an empty bowel with little fat in its wall—tube resection is a practical method of obtaining continuity of the bowel. The rubber tube of $\frac{3}{4}$ inch diameter has a lateral eye near its tip. After the sigmoid is resected, great care being taken to preserve the blood supply to the distal segment, the open end of the tube is passed through the distal segment and caught by an assistant who draws it through the anus. The upper end of the tube with the lateral eye is inserted 3 or more inches into the proximal sigmoid where it is fixed by passing a stitch of heavy catgut transversely through the side of the tube and the wall of the bowel $\frac{1}{2}$ inch above its open end. Traction on the tube approximates the cut ends which are then anastomosed by through-and-through chromic catgut sutures. Then, while the lower segment is steadied by forceps on each side below the anastomosis, downward traction on the tubes invaginates the upper into the lower segment a distance of $\frac{1}{2}$ inch or more. This is maintained by a second row of seromuscular sutures and by passing a large safety pin through the tube close to the anus. About 2 ounces of ether, poured into the pelvis to sterilize the field of operation, are quickly sponged out and the omentum is tacked over the line of anastomosis. The peritoneum behind is closed by suture. A large

cigarette-drain is inserted to the bottom of the peritoneal culdesac and the abdominal wound closed above it. The tube remains until the catgut is absorbed—five to seven days. Meanwhile the bowels are confined by a diet which leaves little residue. The abdominal drain is loosened on the fourth or fifth day but not removed until the seventh day as a temporary fistula may form.



FIG. 379.—RESECTION OF THE SIGMOID WITH END-TO-END ANASTOMOSIS.

Method of beginning the suture at the mesenteric border so as to obliterate the triangular dead space between the leaves of the peritoneum.

Carcinoma of the sigmoid flexure usually produces symptoms early. Examination at this time may discover the disease in an early phase. This, together with the fact that cancer in the mobile sigmoid colon disseminates comparatively late, renders the disease in this situation very favorable for surgical removal.

On the other hand, cancer of the sigmoid is one of the chief causes of intestinal obstruction. It is now a well recognized surgical principle never to perform colonic resection where there is acute obstruction. Consequently, when acute

colonic obstruction is present, cecostomy is established to drain off the septic bowel contents. A week or ten days later the abdomen is opened and if an operable tumor of the sigmoid is found to be the cause, it is treated by radical surgery. When the colon can be emptied by purgatives and enemas the sigmoid may be resected in either one or two stages.

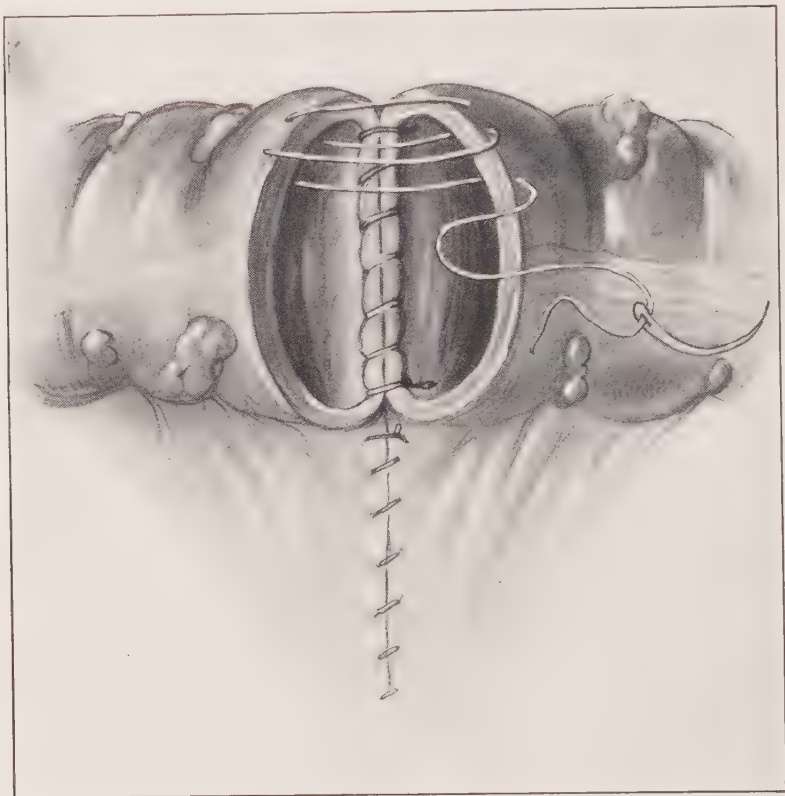


FIG. 380.—RESECTION OF THE SIGMOID WITH THE END-TO-END ANASTOMOSIS.
The suture continued around the bowel.

One-Stage Resection of Sigmoid for Cancer.—Preliminary cecostomy is not essential in favorable cases, but is frequently established at the time of resection to prevent strain on the anastomosis.

The abdomen is opened by a vertical incision through the outer third of the left rectus muscle, extending from the pubic crest to 1 inch above the umbilicus. The wound edges are retracted by a self-retaining retractor, the tumor examined and the abdomen explored for malignant glands and metastases, especially in the liver. The sigmoid is drawn through the wound as far as possible; the abdomen and wound edges protected by gauze pads. The bowel is double clamped 1 or preferably 2 inches above and below the growth, the clamps being applied at an angle to the axis of the gut, as recommended by

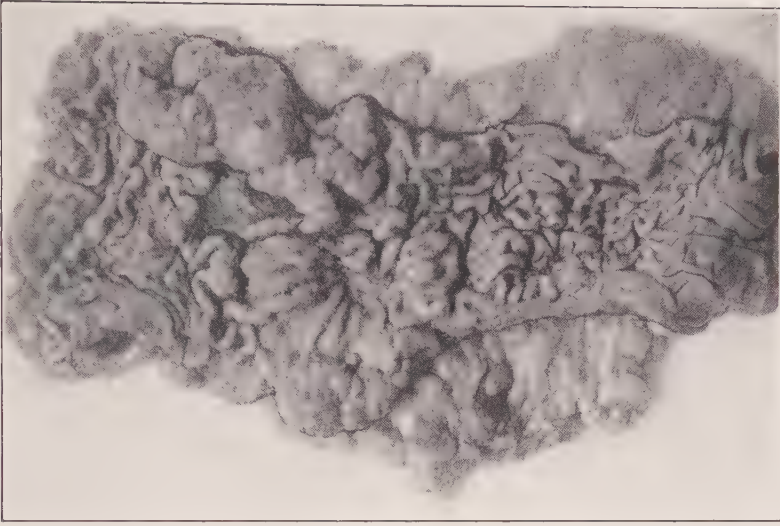


FIG. 381.—ADENOCARCINOMA OF SIGMOID.

One-stage resection with end-to-end anastomosis. Patient, male, aged forty-nine, well without recurrence two and one-half years after operation.

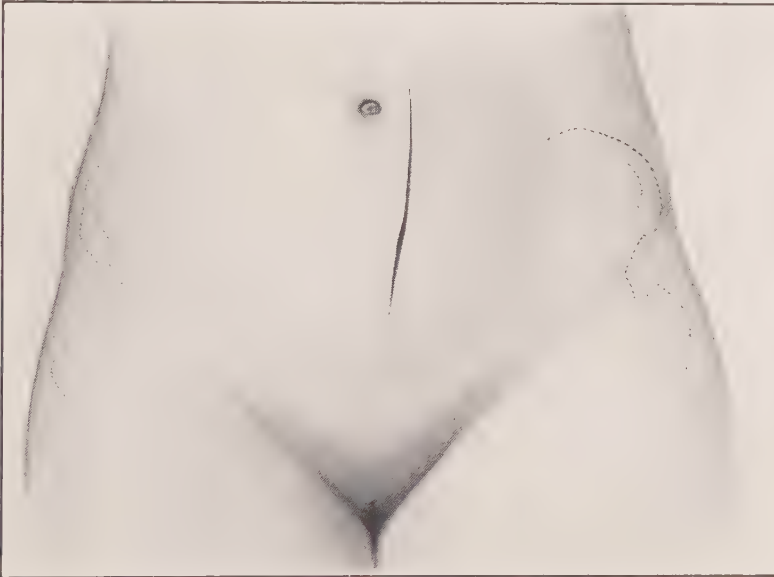


FIG. 382.—TWO-STAGE RESECTION OF SIGMOID (MIKULICZ OPERATION).

Primary incision used for exploration, mobilization of intestine and for removal or mobilization of enlarged lymphatics. (Courtesy of Charles N. Dowd and permission of *Annals of Surgery*, December, 1920. J. B. Lippincott & Co., Philadelphia.)

Mummery, to insure a good blood supply to its free border. The bowel is divided between the clamps, together with a wedge of mesentery containing the lymphatics back to its parietal attachment. Continuity is reestablished by an end-to-end anastomosis with sutures. The Murphy button and other mechanical aids are now seldom used for this anastomosis.

The first suture applied, after the method of Maunsell, is of the greatest importance. It is of fine Pagenstecher linen or chromic catgut 24 inches long

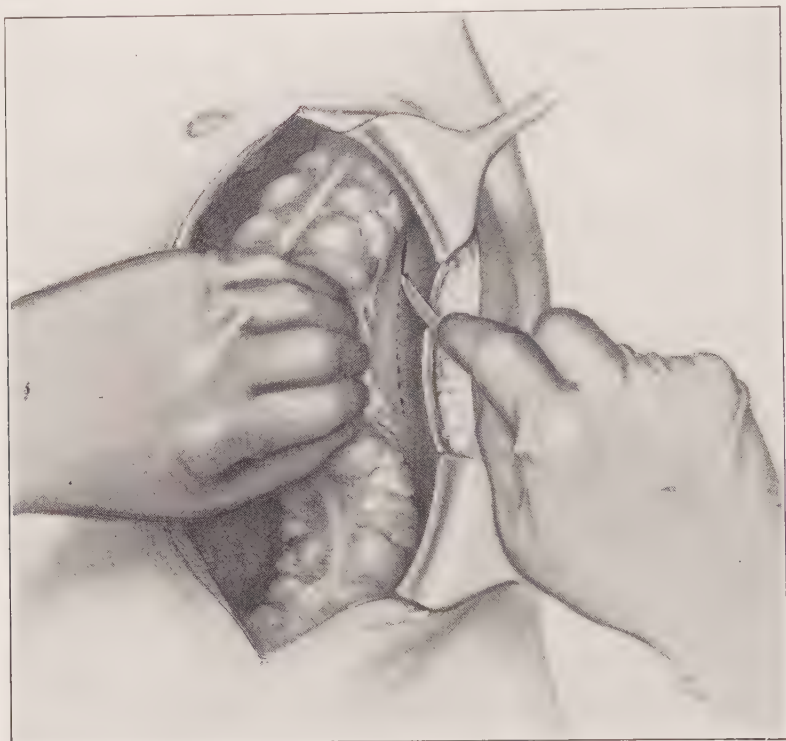


FIG. 383.—TWO-STAGE RESECTION OF SIGMOID (MIKULICZ OPERATION).

Incision of outer leaf of peritoneum beside descending colon so as to secure suitable mobility of that part of colon. (Courtesy of Charles N. Dowd and permission of *Annals of Surgery*, December, 1920, J. B. Lippincott & Co., Philadelphia.)

with a needle at each end. This mesenteric suture (Fig. 379), when tied, obliterates the "dead space" between the leaves of the mesentery and holds the serous surfaces permanently in accurate apposition. The circular closure is completed by through-and-through stitches, passed at least $\frac{1}{4}$ inch from the edge of the gut, using the second needle when one-half the circumference is closed and tying the two ends together where they meet. A second seromuscular continuous suture of fine chromic gut reinforces the union and is continued down to close the mesentery. The anastomosis may be further protected by surrounding it with omentum which is held in place by a suture through each segment.

Two-Stage Resection (Mikulicz Operation).—This is the safest of all methods of resecting the carcinomatous sigmoid but entails several steps and a rather prolonged convalescence. However, its greater safety makes it applicable to the majority of cases for the average surgeon. Mikulicz reduced his mortality of colonic resections in the Breslau clinic from 42.9 per cent by the one-stage operation to 12½ per cent in sixteen cases done by the two-stage method.

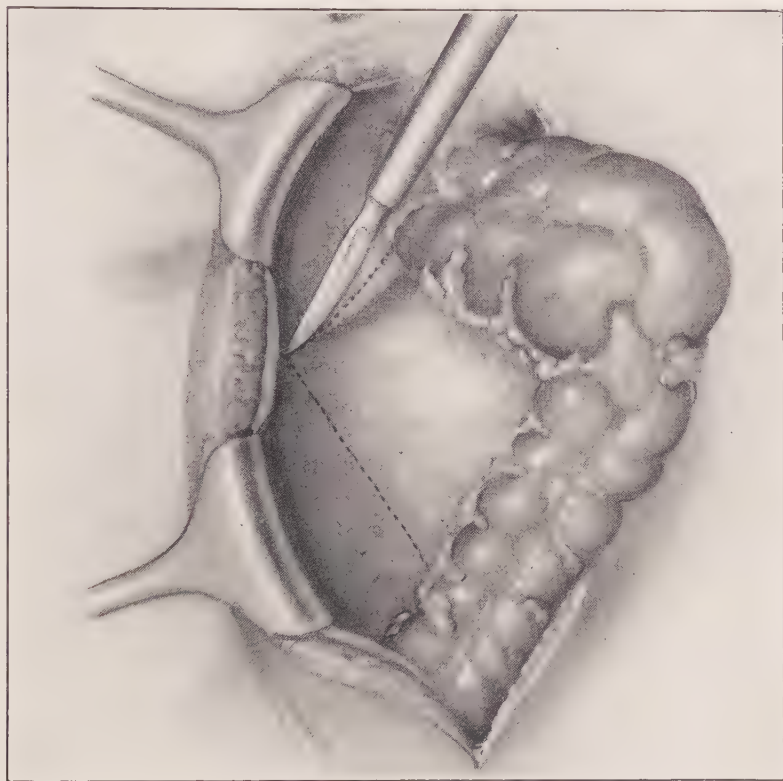


FIG. 384.—TWO-STAGE RESECTION OF SIGMOID (MIKULICZ OPERATION).

Exposure and removal or mobilization of enlarged lymphatics and part of mesosigmoid. (Courtesy of Charles N. Dowd and permission of *Annals of Surgery*, December, 1920, J. B. Lippincott & Co., Philadelphia.)

Technic.—The abdomen is opened and explored as in the one-stage procedure (Fig. 382). Incision of the outer leaf of the peritoneum parallel to the mesenteric attachment (Fig. 383) secures free mobility of the corresponding segment of bowel. On the inner side of the loop a sector of the mesentery and peritoneum, with apex near the midline, is mobilized and raised to the sigmoid (Fig. 384).

It is desirable but not always feasible to remove all the lymphatic area into which the affected portion of gut drains. Fortunately it is not always necessary.

In eighteen cases of cancer of the pelvic colon, Clogg found at autopsy enlarged lymph-nodes in seventeen. All were near the colon except in six instances. He found no cancer cells in the lymph-nodes of one-third of the cases examined, the others being inflammatory hyperplasia.

Through the incised peritoneum the fat and lymphatics are stripped from the vessels toward the sigmoid. Sigmoid arteries to the tumor area are tied and cut. The involved segment thus liberated is drawn through the abdominal wound.

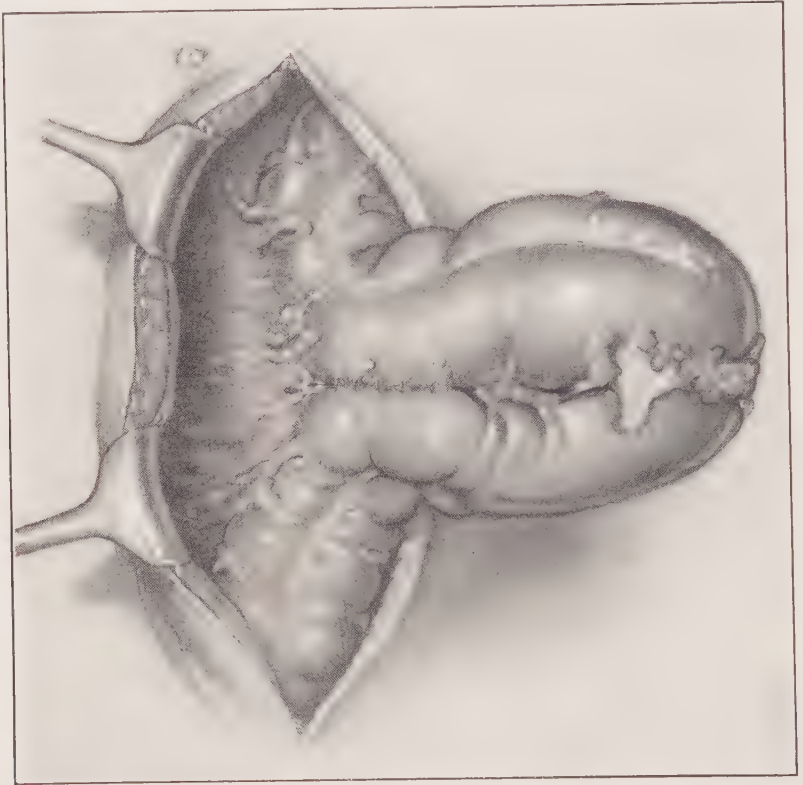


FIG. 385.—TWO-STAGE RESECTION OF SIGMOID (MIKULICZ OPERATION).

Stitching of afferent and efferent legs of intestine so as to form a septum which is suitable for later clamping. (Courtesy of Charles N. Dowd and permission of *Annals of Surgery*, December, 1920, J. B. Lippincott & Co., Philadelphia.)

The denuded area in the peritoneal cavity is covered by suturing the peritoneum over it.

Sound portions of bowel on each side of the tumor and at a safe distance from the growth are approximated a distance of $2\frac{1}{2}$ inches by fine catgut sutures so applied that the upper end of the suture line is at the level of the peritoneum in the abdominal wound. The first row of sutures runs along the mesenteric border, the second through the longitudinal muscular bands. The surfaces thus opposed form a good septum or "spur" for subsequent clamping.

Now, with the tumor on the abdomen, the peritoneum and then the skin is stitched so firmly about the two healthy loops as the abdominal wound is closed, that the intestine cannot retract; or preferably, if the tumor is small, it is brought out through a separate muscle-splitting incision placed farther on the left side to protect the primary incision from infection (Fig. 386). Unless the growth is removed at once, the protruding bowel is covered with rubber dam and surrounded by fluffed gauze. Ablation of the protruding bowel

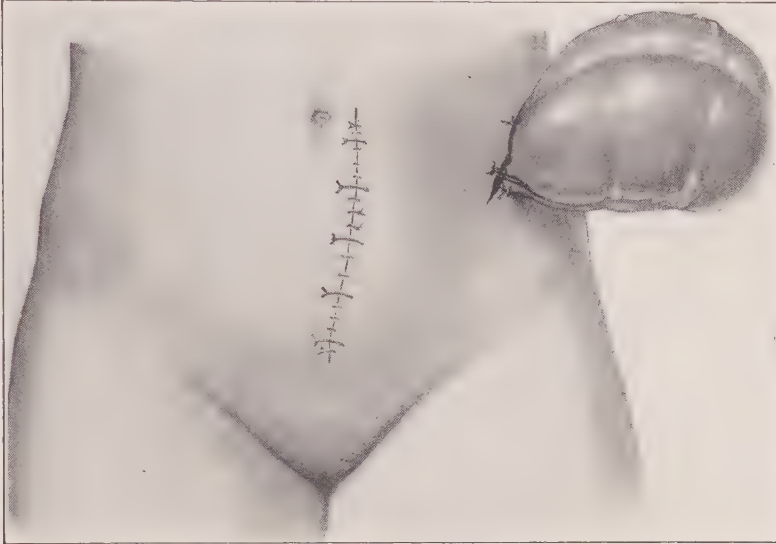


FIG. 386.—TWO-STAGE RESECTION OF SIGMOID (MIKULICZ OPERATION).

Primary wound closed. Diseased intestine delivered through small secondary intramuscular wound. In this instance it was distended by pressure of gas from above. (Courtesy of Charles N. Dowd and permission of *Annals of Surgery*, December, 1920, J. B. Lippincott & Co., Philadelphia.)

may be deferred for twenty-four or forty-eight hours, but as a rule, it is advisable to excise the growth itself by cautery at the time of the primary operation. Enough of the gut should be left above the skin surface that a temporary ligature secured about each protruding end may protect the wound against infection, but the entire mass should not be left to slough. Annoying pressure may be relieved by tying a Paul's tube into the proximal leg for the escape of gas and feces (Fig. 387).

After the wound has healed firmly and there are no signs of infection, which is about eight to ten days after operation, a clamp is applied to cut through the spur. Various clamps have been used. The essential feature is that it should be strong and have long straight jaws. A Kocher or Stetten clamp serves very well. A finger inserted on each side of the septum guides the clamp to its proper position at a depth of 2 or $2\frac{1}{2}$ inches, where it is closed to the first notch of the ratchet. The pressure is increased on successive days and the clamp comes

away in five days to a week. Feces then usually pass both by the artificial anus and rectum, but an operation is almost always required to close the stoma completely.

No attempt should be made to close the stoma until the spur has been cut through so deeply that there is free communication between the two legs of intestine. If digital palpation indicates that the spur has not been obliterated sufficiently, the clamp or enterotome should be reapplied before attempting closure of the stoma.

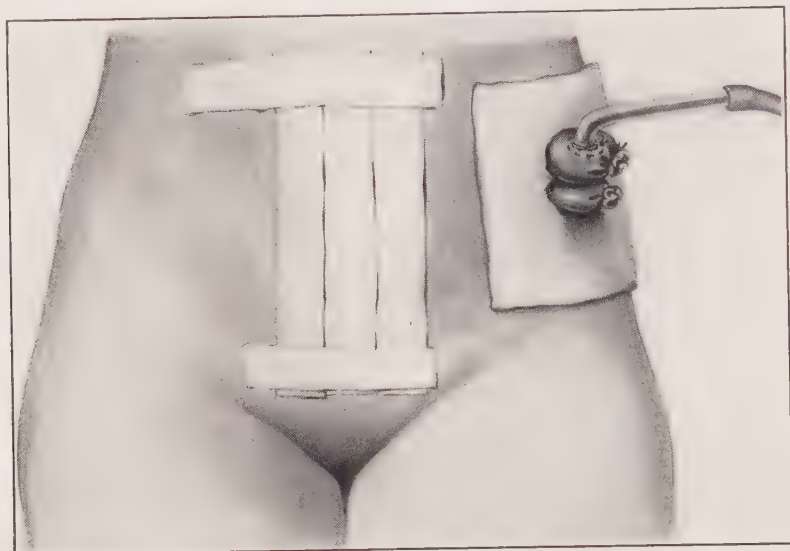


FIG. 387.—TWO-STAGE RESECTION OF SIGMOID (MIKULICZ OPERATION).

Primary wound covered by aseptic dressing. Secondary wound smeared with ointment and protected by gauze. Protruding parts of afferent and efferent intestine ligated. Diseased portion of intestine ablated. Paul's tube inserted in protruding part of afferent intestine so as to secure and temporarily control drainage. (Courtesy of Charles N. Dowd and permission of *Annals of Surgery*, December, 1920, J. B. Lippincott & Co., Philadelphia.)

Closure of the artificial anus is accomplished by either the extra- or intraperitoneal method, the technic of which is given in the chapter on Colostomy. Suffice it to say here, that while the extraperitoneal method is safer, in that it avoids infection of the abdominal cavity, the operation frequently fails and must be repeated. The intraperitoneal procedure is much more certain in procuring primary closure but at the risk of possible infection of the peritoneal cavity.

Causes of Operative Mortality.—Sepsis in one form or another is the chief lethal factor after excision of the rectum for carcinoma. It accounted for five of thirteen deaths in Tuttle's one hundred cases. The operative mortality in Mayo's cases was due to sepsis, 39.8 per cent; nephritis, 13 per cent; undiscoverable metastatic tumor, 10.5 per cent; hemorrhage, 6.5 per cent; ileus, 3 per cent; and miscellaneous, including late exhaustion, the balance. In Mummery's

two hundred cases, sepsis caused seven of the seventeen deaths, the remainder being due to heart-failure, hemorrhage and pneumonia, two each; shock, dilatation of stomach, pulmonary embolism, and pyelonephritis, one each.

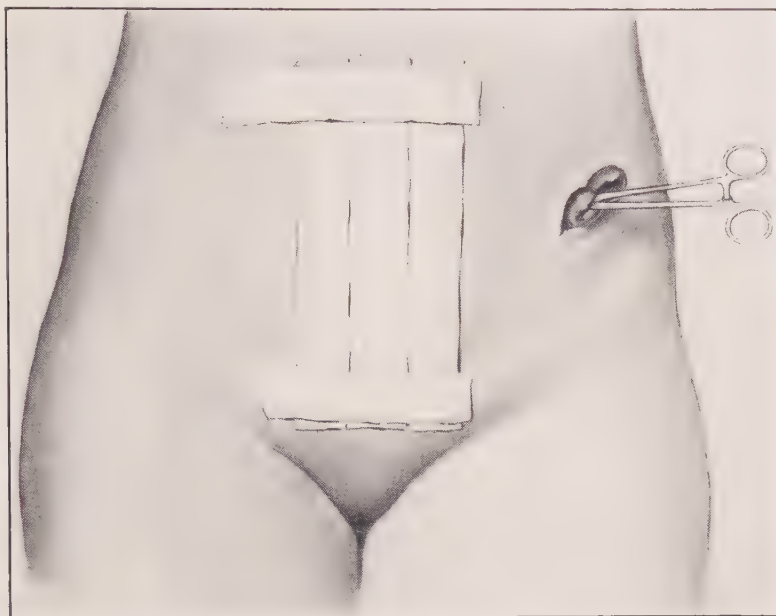


FIG. 388.—TWO-STAGE RESECTION OF SIGMOID (MIKULICZ OPERATION).

Clamp applied to septum. (Courtesy of Charles N. Dowd and permission of *Annals of Surgery*, December, 1920, J. B. Lippincott & Co., Philadelphia.)

Other causes of operative mortality less under control are shock, embolism, hemorrhage and paralytic ileus. The cause of death in seventeen sacral resections and eight combined operations at von Eiselsberg's Clinic were:

<i>Sacral Resection</i>		<i>Combined Operation</i>	
Peritonitis	7	Peritonitis	2
Pneumonia	3	Cardiac insufficiency.....	4
Embolus	2	Embolus	1
Myocarditis	1	Infection of wound.....	1
Metastasis	1		
Infection of wound.....	1		
Ileus	1		
Infection of bladder.....	1		

Although infection will continue to be the main lethal factor, much of it is avoidable by making sure that the bowel is empty before operation and by aseptic technic during operation.

Operative and Postoperative Complications.—*Injury of adjacent organs* is easily avoidable in women, but in men the ureter, bladder, prostate, seminal

vesicles or urethra may be injured while excising low-lying cancers, sometimes resulting in rectovesical or recto-urethral fistulæ.

Shock.—In the perineal and sacral operations, shock is moderate, but frequently severe in the combined operation. The means of most effectively combating it are careful preparation of the patient for operation, blood transfusion within twenty-four hours before operation, hypodermoclysis during operation and spinal anesthesia, supplemented by gas and oxygen.

Hemorrhage.—Preliminary ligation of the superior hemorrhoidal vessels reduces bleeding to a minimum in the combined operation. In the sacral operation bleeding is readily controlled by ligating vessels under direct vision. There is rather free bleeding during the deep dissection in some cases of perineal excision of the rectum, but this can always be controlled by clamps and large gauze packs.

Postoperative hemorrhage is stated to end fatally in 5 to 10 per cent of operated cases. This seems to be an unnecessarily high rate. The author has had only one fatality from this cause, occurring in a man on the tenth day after a combined operation.

Sepsis.—Fecal contamination of the operative field favors wound infection and peritonitis and may result in prolonged exhausting suppuration and sepsis. When the operation can be performed with proper technic, the field of operation is not soiled with feces.

An empty bowel is essential and tight closure of the anus with a purse-string suture as the first step in the operation. Then the only chance of fecal contamination is accidental perforation of the bowel which occurs occasionally when dealing with a large friable tumor.

In the *bone-flap operation*, necrosis of the bone frequently results in chronic suppuration.

Gangrene of the gut is a rare but formidable complication of the combined operation. Impaired blood supply results from inadvertently ligating the nutrient arteries or too great tension when anchoring the bowel to the anus. This condition is evident within thirty-six hours but is not to be anticipated if the bowel-end bleeds freely, as it should, when divided at operation.

If all cases of infection, septicemia, peritonitis, and suppurative cystitis with secondary pyelitis, were grouped under the head of sepsis, this would include approximately 75 per cent of the operative mortality.

Bladder and Kidney Complications.—Suppression of urine is a very serious complication occasionally observed after "low" but more frequently after the combined operation. It seems to be due to injury of the hypogastric plexus of nerves and the effect of general ether anesthesia on the kidneys—a potent argument for spinal anesthesia. Due to the shock and necessary injury during operation of the nerves controlling bladder function, temporary retention of urine is common for three or four days, but in some instances return of function is delayed. The greatest care and asepsis in catheterization are essential to

prevent cystitis and ascending infection of the kidney. This unfortunate complication occurred in one of the author's cases, and suppression of urine was the cause of death in another. Ether anesthesia was used in both instances.

Mortality.—Tuttle collected 1,578 cases of extirpation of the rectum for cancer, done from 1880 to 1900, with a mortality of 319 or 20.2 per cent.

TUTTLE'S TABLE

Method	Number of Cases	Deaths	Mortality Per Cent
Sacral	913	211	23.1
Perineal	569	76	13.5
Abdominal	49	18	36.7
Combined	22	9	40.9
Vaginal	23	3	13.0
Anal	2	2	100.0
TOTAL	1,578	319	20.2

Mortality of Perineal Excision.—Hartmann's collected statistics from eighteen clinics, including his own, showed 264 deaths in 1,665 operations, or a mortality of 18.5 per cent. Of 176 perineal amputations at von Eiselsberg's Clinic (1901-1926) eighteen succumbed, or 10.2 per cent. Due to improved technic and aseptic surgery the percentage of fatalities is now approximately 10 per cent.

Mortality of Sacral Excision (Kraske).—According to Krönlein's statistics, of 1,005 cases operated upon by this method at various large European clinics the mortality was 20.9 per cent. Kraske's mortality in eighty-five cases was 18.7 per cent. Lusk collected statistics of the Kraske operation from fourteen different continental clinics. The operative mortality ranged from 6.4 (Poppert) to 32 per cent (von Bergmann, Schede and Rotter). Bacharach reported a mortality of 13.7 per cent in 320 cases operated at Hochenegg's Clinic. The recent figures (1926) at Eiselsberg's Clinic gave an operative mortality of 16 per cent in 107 cases. Hartmann states that the average mortality for French, English and American surgeons is 15 per cent.

Mortality of Combined Operation (Abdominoperineal and Abdominosacral).—Pennington added sixty collected cases to the 260 gathered by Hartmann from twenty-one clinics besides his own, a total of 320 cases, with 129 deaths or 40 per cent operative mortality. Miles performed 116 radical abdominoperineal operations. The mortality in the sixty-four men was sixteen (23.4 per cent), and in the fifty-two women, fourteen (26.9 per cent); average 25 per cent. The Mayos performed nineteen combined operations with permanent colostomy: mortality 26.3 per cent.

Sigmoid Colon.—Radical operation for carcinoma of the sigmoid in the presence of acute obstruction bears a high mortality. Operative deaths of Rotter and four others were 60 per cent for resection; while Körte and others lost eighteen of twenty-three patients (78 per cent) in whom anastomosis was done. Even late colostomy, when the patient is toxic from ab-

RESULTS OF RADICAL EXCISION OF CARCINOMA OF THE RECTUM

Source	Number of Cases	Operability Percentage	Type of Operation	Operative Mortality Percentage	Years of Survival Excluding Deaths from Operation and Other Causes			Remarks
					1-3 Years	3-5 Years	Over 5 Years	
Hartmann	1665 260		Perineal and sacral Combined	15.8 37.0		26.0		From 17 clinics besides his own From 21 clinics besides his own
Hochenegg	500			18.9			20.0	Sacral anus in two-thirds of cases
Eiselsberg's Clinic (1901-1926)	176 107 16		Perineal amputation Sacral (Kraske) Combined	10.2 16.0 50.0		30.0 35.0	22.0 30.0	
Cripps (1907)	108	25.0	Perineal	15.0		39.0		8 per cent of all cases seen alive at 3 years
Miles Ether, chloroform (1907-1914) Spinal anesthesia (1919-1923) TOTAL	63 53 116	29.3	Combined	36.2 9.4 25.0		47.7		Recurrence 29.5 per cent in 44 cases; 16 patients alive 6 to 11 years after operation
Mummery (1926)	200		Colostomy and posterior excision	8.5		36.5	22.5	25 per cent of all cases seen alive at 3 years
St. Mark's Hospital (London) Gabriel (1910-1924)	143	44.0	Colostomy and posterior excision	15.4		28.5	28.0	10 per cent of all patients seen alive at 3 years
Tuttle (1908)	100		Perineal (40) Sacral (37)	13.0	30.0	26.0	21.0	

RESULTS OF RADICAL EXCISION OF CARCINOMA OF THE RECTUM—Continued

Source	Number of Cases	Operability Percentage	Type of Operation	Operative Mortality Percentage	Years of Survival Excluding Deaths from Operation and Other Causes			Remarks
					1-3 Years	3-5 Years	Over 5 Years	
Mayo Clinic Rectum and rectosigmoid (1893-1915)	430	57.0	Various Mostly colostomy and posterior ex- cision	15.5 8.9	40.0	33.0 38.8	28.5 33.7	All true rectal cancers below rectosigmoidal juncture
	602	34.9						
Lynch (1918)	335			16.0	25.7	16.4	12.8	
Jones (1927)	178	65.0	Combined abdom- inoperineal	23.		69.0	52.0	34 per cent of all cases seen alive at 3 years
Coffey * (1928)	65	40.0	Coffey technic, in- version of sigmoid through rectum, in 32 cases operated upon more than 5 years ago.	6.25	63.3		43.3	8 patients alive and well 5 to 13 years after operation. 3 died from other causes 5 or more years after operation. 8 recur- rences (5 local, 3 liver) 7 months to 6 years after opera- tion.
Yeomans (1926)	89	58.	Combined (13) Perineal (19)	22.0	64.0	48.0	21.5	Operative mortality and per- centage of survival refers to author's 32 cases.

* Personal communication.

sorption, was followed by death in forty-three of one hundred cases (Rotter, Körte).

In cases uncomplicated by acute obstruction, operation in two stages is much safer than in one stage. Körte, combining his own statistics with those of eight other surgeons, found an operative mortality of 42.4 per cent in 207 consecutive one-stage operations; while with the two-stage method it was only 15 per cent in 146 cases.

Recurrence.—Early diagnosis and earlier excision would reduce materially the mortality and rather high percentage of recurrences. The chief path of cancer spread is the lymphatics which have attained their maximum of activity at adolescence, and, like the tonsils and other lymphoid structures, slowly retrogress with advancing years. Consequently the younger the patient the more frequent and quick is recurrence. Patients in middle life are a better surgical risk, but those in advanced years who survive are less liable to recurrence.

Recently Clark summarized the results in all cases of cancer of the rectum under twenty years of age, appearing in the literature, including one of his own—fifty-two in all. The diagnosis is rarely made, only eight times in fifty-two cases. The course is rapidly fatal, seven to eight months after the symptoms are established. Of seventeen cases operated upon, eleven recovered from the operation, five of these died within two weeks, three others from ten months to two years, leaving only three actual recoveries.

Tuttle's experience goes to show that the higher the tumor is situated in the bowel the higher the percentage of operative mortality, while the percentage of recurrence is the reverse. Of his nineteen cancers within 2 inches from the anal margin, there were no deaths but ten recurrences; in thirty-three tumors above the 5-inch level, seven died but only six recurred. The logical explanation of this difference in recurrences seems to be the preponderance of lymphatics around the anus in comparison with those at higher levels. However, other authorities find no relation between the site of the tumor and frequency of recurrence. Growths in the anal canal and those in the anterior rectal walls show a greater proclivity to recurrence than those situated elsewhere.

Hassler found local recurrence in 52 per cent of twenty-two cases. In the majority of cases the growth recurs at the site of operation, in the scar tissue or lymph glands; or metastatically in the lymph-nodes, liver, lungs, or other organs. Miles abandoned the perineal operation following recurrence in fifty-five of fifty-eight cases in which he used this method. Of forty-four traced patients operated upon by the combined method fifteen months or more prior to his report in 1923, thirteen or 29.5 per cent had died of recurrence. Recently Mummery has reported in detail, the results in two hundred cases of perineal excision of the rectum, of which seventy-three were favorable for operation, ninety-six medium and thirty-one very extensive growth.

The results of traced cases on a five-year basis were:

Type	Total	Cures (five-year basis)	Recurrences	Percentage Cured
Favorable	30	22	8	73.3
Medium	43	19	24	44.1
Extensive	9	4	5	44.4

The selected favorable cases naturally show the highest percentage of cures and smallest percentage of recurrences, but it is noteworthy that several of the unfavorable cases did so well.

The majority of recurrences occur within two years of operation. Consequently "cure" is usually reckoned on a three- or five-year basis, but occasionally there is a return of the growth after seven or even eight years.

Function Following Operation.—Control of the bowels following operation for cancer of the rectum or sigmoid colon is of the greatest moment to the patient. So great is his desire to preserve function that frequently he will accept an operation having definite increase in possible mortality and diminished prospects of eradicating the disease.

For cancers of the pelvic colon, excellent functional results are obtained by the tube method of Balfour. The "draw-through" method of Weir, whereby the growth is invaginated through the anus, amputation performed and direct through-and-through suture from the mucous surface carried out, has given good results but is unfortunately practicable in very few cases. The writer did a modification of this technic in two cases, first resecting the growth through the abdomen, then invaginating the sigmoid through the everted rectum. Excellent functional results were obtained and both patients are living and enjoying good health, five and five and one-half years respectively after operation.

After the perineal operation continence varies. Preservation of the sphincter has less to do with control after the perineal operation than other factors, for the operation destroys the innervation of the sphincter muscles and they tend to atrophy into fibrous bands. Moreover, the close proximity of the neoplasm to the anus or its actual involvement, in the majority of cases in which the perineal operation is indicated, compels their sacrifice if we would eradicate the disease. Although a pad is usually worn as a precaution, some patients after wide excisions including the sphincters, have remarkable control. In two patients, both women, in whom the author amputated the lower 3 inches of the rectum and a large shield-shaped area of perineum including anus as far back as the coccyx, both had excellent control and one of them (now two years after operation) has warning of desire to defecate.

In the abdominoperineal operation where the sigmoid is drawn down and sutured at the anal canal the functional results are variable but fairly good in many cases.

Continence is comparative: Perfect is normal function, partial inconti-

nence when there is control over formed feces, complete when both formed and liquid feces escape unconsciously. Gant's figures on function in two hundred cases of his own were continence, 25 per cent; partial incontinence, 65 per cent; complete incontinence, 10 per cent.

The results in Tuttle's cases of resection were perfect control in twenty-two, and partial incontinence in seven. When the gut was sutured to the margin of the anus, sixteen patients had perfect continence, thirteen mild incontinence, and thirteen had almost complete incontinence. All patients left with a sacral anus suffered greatly from incontinence.

Resection carries a higher mortality and frequently a longer hospitalization than amputation, but its ultimate results in comfort to the patient are more satisfactory. As advised by Gersuny, twisting the gut 90 degrees or more before anchoring it, aids continence. Our chief reliance, however, is physiological control through regulating the diet and establishing a twenty-four or forty-eight hour habit of bowel evacuation.

Posterior Fecal Fistula.—Separation of the suture line and fecal fistula formation is a frequent occurrence after the Kraske method of sacral resection. This occurred in twenty-six of ninety-five cases at von Eiselsberg's Clinic, but in only two of the patients followed up was a receptacle necessary. Usually the fistulae closed spontaneously in from three to four months.

Procidencia Recti.—Partial excision of the sacrum, division of the supporting soft tissues and removal of the sphincter is occasionally followed by varying degrees of rectal prolapse. In von Eiselsberg's series this did not occur in any case of resection, but prolapse followed amputation of the rectum in thirteen of 160 cases. In the writer's experience prolapse has seldom occurred, when the anus is placed at its normal site. Prolapse of the mucous membrane alone is controlled by removing longitudinal strips of mucosa at three or four points with the clamp and cautery. In cases of complete prolapse, recurrence is apt to follow amputation, and measures described elsewhere must be employed for its relief.

CHAPTER XXXI

SARCOMA OF THE RECTUM

Incidence.—Sarcoma of the rectum is a very rare condition. Only about one hundred cases have been reported in the literature and it is doubtful if all of these were true sarcomata. They occur under two general types, *non-melanotic* and *melanotic* sarcomata, the latter predominating in the proportion of two to one. The occurrence of sarcoma in relation to carcinoma of the rectum is in about the ratio of one to two hundred.

Kruger's statistics show the distribution of the tumors in the intestinal tract:

Small intestine	16
Ileum and cecum.....	1
Cecum	1
Vermiform appendix	1
Transverse colon	1
Small and large intestine.....	1
Rectum	16
	—
TOTAL	37

In 106 cases of sarcoma, Verbely found thirty-six in the appendix, eleven in the transverse colon, fifty-five in the sigmoid, and four in the rectum.

Age.—Of Kruger's, three were in the first and three in the second decade. In Chalier and Bonnet's reported series of melanosarcoma, thirty-nine of fifty-five cases were between forty and seventy years of age.

Sex.—Of these melanotic cases, thirty-seven were males, eighteen females; of sixty-eight non-melanotic cases, forty-two were males (Du Costel, Whiteford, and others).

Site.—Sarcomata may be situated at any portion of the rectum or sigmoid but the large majority are within the distal three inches of the anorectal canal. Lapeyre states that in twenty-four cases, two were anorectal, nine just above the sphincters, five within lower two inches, six in ampulla, and two at recto-sigmoid junction. The majority were on the anterior and lateral bowel walls. Of thirty-one cases of melanosarcoma, only three occupied the anterior wall; ten were lateral, and eighteen posterior.

Pathology.—*Form.*—Sarcomata usually begin as small nodular round or elliptical deposits beneath the mucosa, and tend to assume a polypoid form. Their surface is uneven and in the earlier stages the mucosa is movable over

the growth, a characteristic which distinguishes them from carcinoma. Later the growing tumor invades the mucosa, evidenced by its fixation to the growth, and ulceration may occur, accelerated in part by fecal trauma of the protuberant neoplasm. Sarcoma may also take the form of a general fibrous thickening of the rectal wall, and thus be mistaken for simple fibrous stricture.

Number.—Rectal sarcomata are usually single, twenty-nine of thirty cases in Lapeyre's series. Ball's patient had three distinct growths. In one of Tuttle's cases there were two tumors: One polypoid and protruding from the anus, the other submucous and involving about one-half of the circumference of the rectum.

In *size*, the tumors vary from that of a pea to a fetal head, the larger growths producing definite symptoms of obstruction. In Tuttle's patient, the growth was very extensive but encroached only slightly on the bowel lumen, obstructing chiefly the anus.

Consistence.—Sarcomata are relatively hard to the touch, but are generally less indurated than carcinoma. After ulceration occurs, they usually become a soft spongy

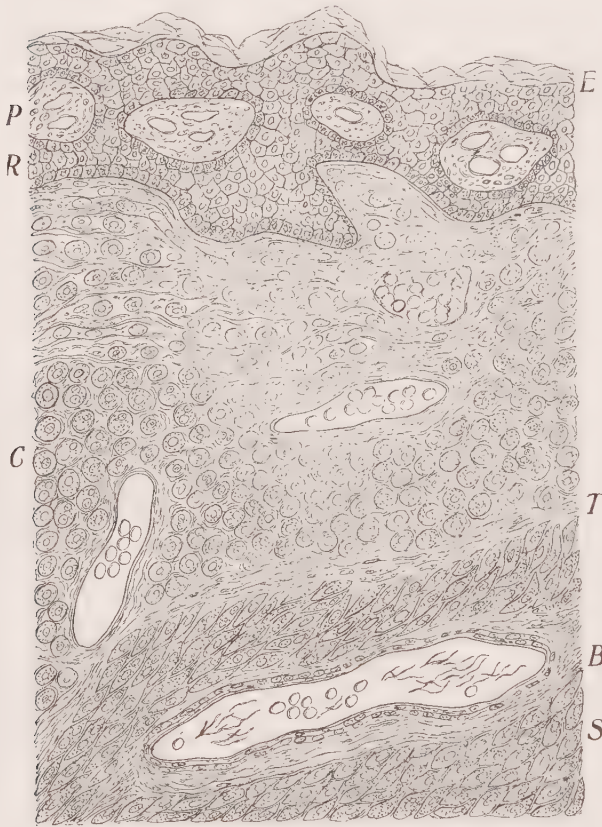


FIG. 389.—ROUND-CELL AND SPINDLE-CELL SARCOMA (MAGNIFIED 400 DIAMETERS).

E, epidermis; P, papillæ, cut transversely; R, rete mucosum; C, round, nucleated sarcoma cells; S, nucleated spindle-shaped cells; B, blood-vessel; T, connective tissue.

mass. The spindle and round-cell varieties are not as dense as fibrosarcoma and osteosarcoma. In the polypoid form, the sarcoma is elastic, with a firm center, markedly resembling an adenomatous polyp, but differs in having induration of the pedicle.

Color.—The covering of sarcomata of the rectum may present the appearance of normal mucosa. In the melanotic variety, the growth is usually bluish, but black when ulcerated, or if hemorrhage has occurred within its substance,

the dark hue may be mistaken for gangrene. In Ball's patients one of the tumors was black and melanotic, the other pale and blanched.

Pigmentation of melanosis does not alter the cell type of a sarcoma. According to Martin-Rives, and others, the histologic type in seventeen melanomata was: Spindle-cell, six; round-cell, four; mixed, five; and giant-cell, two. One portion of a tumor may be pigmented while other portions are free, and when multiple nodules or tumors are present, one may be melanotic while the others are exempt. Melanin is a dark iron-free pigment, a product of cell metabolism. Chalier and Bonnet found the melanin (*a*) accumulated in the cytoplasm of the tumor cells, (*b*) as fine granules in the connective tissue between the tumor cells, and (*c*) round or spindle-shaped masses, much larger than a tumor cell, probably composed of fused cells impregnated with pigment.

Sarcomata originate chiefly from the submucosa and are composed of embryonal (immature) connective tissue. Histologically there are several varieties of sarcoma, named according to the shape of the cells: Round cell, spindle or fusiform fibro, giant-cell, alveolar, and mixed.

The cells of origin of *lymphosarcoma* are in the solitary lymph-follicles.

Fibrosarcoma, the spindle-cell type, has its chief point of origin in the muscular coat of the bowel and the tumor is usually mixed, *i.e.*, myo-, adeno-, or myxo-sarcoma.

Melanosarcoma, melanoma, is a rare tumor of the intestinal tract. Its site of occurrence is practically limited to the anorectal region, usually as a single,

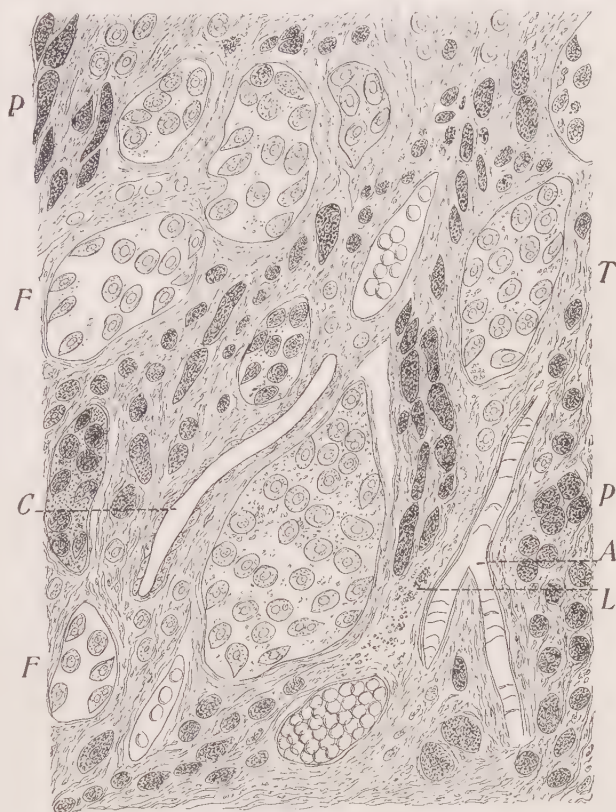


FIG. 390.—MELANOTIC ALVEOLAR SARCOMA (MAGNIFIED 400 DIAMETERS).

PP, groups of pigmented corpuscles; *L*, pigment clusters; *FF*, alveoli containing round, spindle and pear-shaped cells; *C*, capillary; *A*, artery; *T*, connective tissue.

seldom as multiple melanosarcomata. Chalker and Bonnet, who have given the subject thorough study, consider that primary melanosarcomata of the anorectal region begin as skin epitheliomata which infiltrate up beneath the rectal mucosa. Some authorities concur in this view which would make these neoplasms melano-epithelioma, instead of melanosarcoma. Ewing regards groups of chromatophores located in the submucosa as their point of origin.

The small round-cell sarcoma is the variety usually found in the rectum, the spindle and alveolar types less frequently.

The tumor mass is chiefly composed of embryonal cells, with scanty cytoplasm and round vesicular nuclei. The intercellular substance varies in amount and character and is usually scanty.

Sarcomata are characterized by their abundant vascularity. The fragile vessels are frequently composed of a single endothelial layer in direct contact with the neoplastic cells, and widely dilated. As a consequence, hemorrhage is apt to occur into the tumors and, secondly, detached tumor cells, carried in the blood stream, explain the characteristic metastases of sarcoma through the blood current. The growth may also follow and directly invade the blood-vessels. Carcinoma usually metastasizes through the lymphatics, sarcoma comparatively rarely. Alveolar sarcoma may be mistaken for carcinoma. Its chief point of distinction under the microscope is a close examination of the walls of the blood-vessels which, in sarcoma, are generally absent or very thin; while in carcinoma they are either normal or thickened.

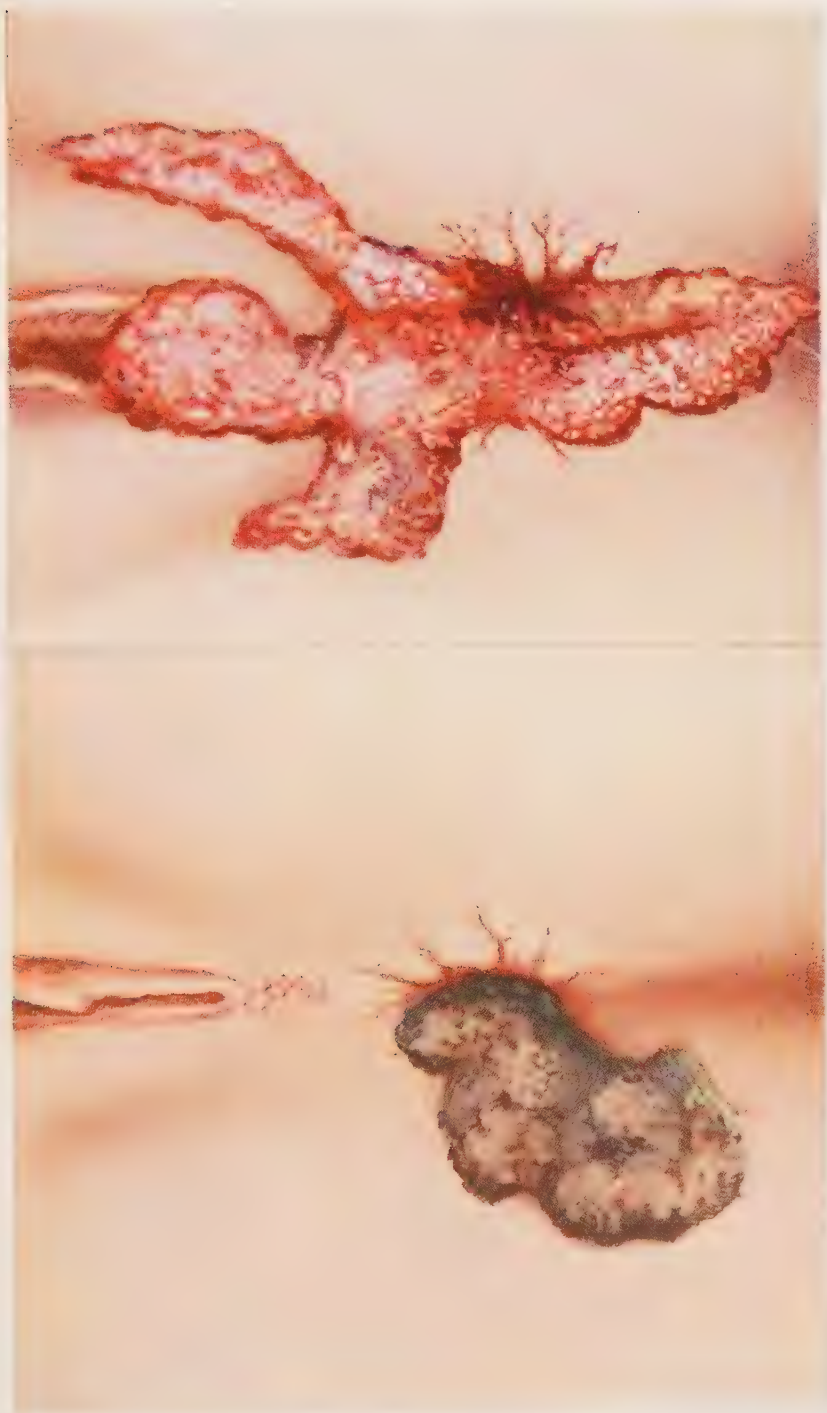
Metastases.—Metastasis is a notable characteristic of sarcoma of the rectum. The rectal growth may itself be metastatic, or, if primary, may already have metastasized, either condition precluding operation. In lymphosarcoma, early metastases occur in the regional lymph-nodes, abdominal lymphatics and organs—lungs, liver, spleen and kidneys—with a fatal termination in one to eighteen months in untreated cases.

Fibrosarcoma is a rapidly invasive, highly malignant neoplasm which metastasizes mainly through the blood current.

Melanosarcoma, expanding in the submucosa, compresses the muscular coat and may invade the perirectal tissue and lymphatics. When situated at the anus, metastases appear in the inguinal lymph-nodes. Although almost any organ may be involved, the liver and lungs are the most common sites of metastases.

Course.—Sarcomata exceed all other rectal neoplasms in the rapidity of their growth. They develop much more rapidly than carcinomata, and fatal termination is much sooner. Weeks' patient, a man aged forty, died of generalized sarcomatosis seven months after the first symptom—blood in his stools.

Symptoms.—In general they are the same as those of carcinoma plus a rather common protrusion of the tumor from the anus. The early symptoms of sarcoma of the rectum are not pronounced. Functional disturbances, a feeling of fullness or tenesmus may have existed for weeks or months before consulting the physician. Constipation is usual, but in some cases diarrhea has been persistent.



MALIGNANT NEOPLASMS.

Upper, EPITHELIOMA OF ANUS AND VULVA

Lower, MELANOSARCOMA

Bleeding does not occur early as in carcinoma. The mucosa remains intact until the disease has made considerable progress. After ulceration of the mucosa has occurred, bleeding is a prominent symptom. Occasionally melena has been the first symptom noted by the patient. *Pain* is not marked when the growth is well within the rectum proper, but when the anal canal is involved it is apt to be pronounced.

Protrusion of the tumor through the anus is a relatively common occurrence. The extruded mass, if large, is replaced with difficulty, and while out, pain is severe and bleeding frequently profuse.

General symptoms are reflex digestive disturbances and in the later stages, progressive emaciation, weakness and anemia, ending in exhaustion.

Diagnosis.—By the usual methods of palpation, one should be able to discover the tumor. A correct diagnosis of its nature, however, is seldom made clinically before the condition is inoperable or the removed tumor has been studied microscopically. The dark color of melanosarcoma is very suggestive, but melanoma may be mistaken for hemorrhoids, or prolapse. Sarcoma is to be distinguished especially from carcinoma, benign tumors and stricture. Sarcoma is more lumpy and circumscribed than carcinoma, and in the early stages the intact mucosa moves freely over it. Carcinoma, on the contrary, always develops in the mucosa, ulcerates early and is very seldom pigmented.

If the sarcoma is polypoid, it is to be differentiated from other pedunculated tumors occurring in the rectum. Multiple adenomata are soft, and usually are found in younger people. Induration of the pedicle is only suggestive, for adenomata are prone to cancerous degeneration, the point of attachment then becoming indurated. Benign tumors arising from the connective tissue are dense and firm, and grow slowly.

The diffuse infiltrating form may be mistaken for a chronic inflammatory process, *viz.*, stricture or tuberculosis. In the latter, tuberculous lesions are almost invariably present elsewhere, and the growth is slower.

An inflammatory stricture develops very slowly, quickly becomes annular, involves the mucosa which is ulcerated; pus is the chief element in the discharge and it does not metastasize. Histologic study of a biopsy specimen would decide the diagnosis, but it is not advisable to cut through an intact mucosa to obtain a section of the tumor proper, and anything short of this would be pernicious and valueless.

Prognosis.—Owing to the rapidity of growth and early wide metastases the prognosis is exceedingly grave. Early recurrence as a rule follows operation, very few of the cases surviving one year. Yet, Paul, Bernays and Esmarch reported survivals without recurrence of one, nine and five years, respectively. Lapeyre removed by perineal resection from a man aged fifty-three, a spindle-cell sarcoma involving two-thirds of the circumference of the rectum. The patient died four years later with metastases to the liver and ascites.

Tuttle had one patient with lymphosarcoma, who survived five and one-

half years without recurrence. Another patient from whom he had removed an extensive melanotic sarcoma, illustrated in Plate IV, was alive and well two years after operation.

Chalier and Bonnet rate the operability of melanotic sarcoma at 68.7 per cent, a rather high figure. The operative mortality in forty-four cases was 11.36 per cent.

Treatment.—In early cases radical perineal resection of anus and rectum, and destruction of the inguinal lymph-nodes by electric coagulation, is indicated. Any polypoid growth of the rectum, in which doubt exists as to its malignancy, should be removed radically and widely at its base, preferably by electrothermy. Radiotherapy should be employed after operation to prevent recurrence and inoperable cases should be treated by efficient radiation.

REFERENCES

- ALVAREZ, W. C., JUDD, E. S., MCCARTY, W. C., and ZIMMERMAN, A. R. *Arch. Surg.*, Chicago, Vol. 15, Sept., 1927.
- BALFOUR, Donald. *Ann. Surg.*, Phila., 1910, Vol. 51.
- BALL, C. B. *The Rectum*, London, 1894.
- BELL, W. B. *Lancet*, 1, March 13, 1926.
- BENSAUDE, R. *Traité d'Endoscopie*, 2nd Ed., Paris, Masson, 1926.
- BLAND-SUTTON, J. *Tumors Innocent and Malignant*, New York, 1922.
- BLUMER, George. *Albany M. Ann.*, May, 1909.
- BOWING, H. H. *Radiology*, May, 1925.
- BOWING, H. H., and ANDERSON, F. W. *Am. J. Roentgenol.*, Vol. 10, March, 1923.
- BRODERS, A. C. *Collected Papers of the Mayo Clinic*, 1925, Vol. 17.
- BUIE, L. A. *Tr. Am. Proctol. Soc.*, 1923.
- "Cancer Control Symposium," *Surg., Gynec. & Obst.*, Chicago, 1927, Vol. 44, No. 5-A.
- CHALIER, A., and BONNET, P. *Rev. de chir.*, 1912, Vol. 46; 1913, Vol. 47.
- CLAIRMONT, P. Zweifel-Payr in *Klinik der Bosartige Geschwulste*, Hirzel, Leipzig, 1925, Vol. II.
- CLARK, J. H. *Ann. Surg.*, Phila., Dec., 1926.
- CLARK, Wm. L., MORGAN, J. D., and ASNIS, E. J. *Radiology*, April, 1924.
- COFFEY, Robert C. *Surg., Gynec. & Obst.*, Chicago, June, 1924, Vol. 38, No. 6.
- CRIPPS, Harrison. *Cancer of the Rectum*, London, 1907.
- DUKES, C. *Brit. J. Surg.*, Bristol, Vol. 13, April, 1926.
- EWING, J. *Neoplastic Diseases*, 2nd Ed., Philadelphia, W. B. Saunders Co., 1922.
- GABRIEL, W. B. *Brit. J. Surg.*, Bristol, Jan., 1925.
- GANT, S. G. *Diseases of Rectum, Anus and Colon*, Philadelphia, W. B. Saunders Co., 1923.
- GYE, W. E. *Lancet*, Nov. 13, 1926.
- HANDLEY. "Discussion on Surgical Treatment of Rectal Cancer," *Brit. M. J.*, Lond., 1912, 5, X.
- *Zentrabl. f. Chir.*, Leipz., 1913, p. 577.
- HARTMANN, H. *Ann. Surg.*, Phila., 1909, 1: 1091.
- HOCHENEGB. *Deutsch. Chir. Kongrez*, 1900.
- JANEWAY, H. H. *Am. J. Roentgenol.*, Detroit, Vol. 7, Feb., 1920.
- JONES, D. F., and MCKITTRICK, L. S. *Ann. Surg.*, Phila., Vol. 76, Sept., 1922.

- JONES, D. F. *J. Missouri M. Ass.*, St. Louis, May, 1927.
- KELLY, H. A., and WARD, G. E. *Surg., Gynec. & Obst.*, Chicago, Vol. 27, Nov., 1923.
- KIGER, W. H. *Tr. Am. Proctol. Soc.*, 1922.
- KÖRTE, W. *Arch. f. klin. Chir.*, Berl., 1913, Vol. 102.
- KÜTTNER, H. *Ztschr. f. Chir.*, 1916, p. 905.
- LAPEYRE, N. C. *Rev. de Chir.*, Paris, 1920, Nos. 3, 4, 6.
- LAZARUS-BARLOW, and LEEMING. *Brit. M. J.*, Lond., Aug. 16, 1924.
- LEVIN, I. J. *Am. M. Ass.*, Vol. 90, Jan. 28, 1928.
- LYNCH, J. M. *Ann. Surg.*, Phila., April, 1918.
- MARTLAND, H. S., VON SOCHOCKY, S. A., and HOFFMAN, H. J. *Am. M. Ass.*, March 19, 1927.
- MAYO, C. H. *Surg., Gynec. & Obst.*, Chicago, April, 1914.
- MAYO, Wm. *Ann. Surg.*, Phila., 1916, 64: 304.
- McVEY, J. R. *Ann. Surg.*, Phila., Vol. 76, Dec., 1922.
- MILES, W. E. *Brit. M. J.*, Lond., 1913, Vol. 1.
- *Cancer of the Rectum*, London, Harrison and Sons, 1923.
- MUMMERY, J. P. Lockhart. *Brit. J. Surg.*, Bristol, 1926, Vol. 14, No. 53.
- MURRAY, J. A. *Eighth Scientific Report of Imperial Cancer Research Fund*, London.
- OEHLE, J. *Beitr. z. klin. Chir.*, Tübing., 1913, Vol. 78.
- PENNINGTON, J. R. *J. Am. M. Ass.*, Vol. 71, 1918.
- PETERSON and COLMERS. *Beitr. z. klin. Chir.*, Tübing., 1901, Vol. 44.
- POPERT. *München. med. Wchnschr.*, 1906, Vol. 31.
- QUÉNU, E. *Presse méd.*, Par., 1896, No. 91.
- QUICK, D. A., *Am. J. Roentgenol.*, Detroit, Dec., 1921.
- RANKIN, F. W., and BRODERS, A. C. *Surg., Gynec. & Obst.*, Chicago, May, 1928.
- ROGERS, Leonard. *Glasgow M. J.*, 1925, 103: 95.
- ROSSER, Curtice. "Rectal Pathology in the Negro," *J. Am. M. Ass.*, Vol. 84, Jan. 10, 1925.
- ROTTER, E. *Arch. f. klin. Chir.*, Berl., 1913, Vol. 102.
- ROYSTER, H. A. *Nat. M.*, 1914, 6: 221.
- SCHÖNBAUER, L., and PFAB, B. (Eiselsberg's Clinic). *Wien. med. Wchnschr.*, 1926, No. 44.
- SCHREINER, B. F. *Arch. Clinical Cancer Research*, Vol. 1, July, 1925.
- SLYE, Maud J. *Am. M. Ass.*, May 22, 1926, Vol. 86.
- SYMMERS, Douglas. *Am. J. M. Sc.*, Phila., 1917, Vol. 154, No. 8.
- TUTTLE, J. P. *Diseases of the Anus, Rectum and Pelvic Colon*, New York, D. Appleton & Co., 1902.
- *N. York M. J.*, Sept. 5, 12, 19, 26, 1908.
- *Am. J. Surg.*, N. Y., 1910, Vol. 24, No. 6.
- U. S. CENSUS BUREAU, Washington, 1924.
- VEDDER, Edward H. *J. Am. M. Ass.*, May, 1927, Vol. 88.
- VERSE, M. *Arb. a. d. path. Inst.*, Leipz., 1908, Part 5.
- WARD, G. E. *J. Am. M. Ass.*, Feb. 28, 1925.
- WEEKS, J. H. "Sarcoma of the Rectum," *Surg., Gynec. & Obst.*, Chicago, 1927, Vol. 44, No. 1.
- WELLS, H. Gideon. *J. Am. M. Ass.*, Feb. 5-12, 1927.
- WYETH, Geo. A. *Surgery of the Neoplastic Diseases*, New York, Hoeber, 1926.
- YEOMANS, F. C. "Carcinoma of the Rectum and Rectosigmoid," *Med. J. & Rec.*, May 21, 1924.
- "Carcinomatous Degeneration of Rectal Adenoma," *J. Am. M. Ass.*, Sept. 10, 1927.

CHAPTER XXXII

COLOSTOMY

A colostomy is the formation of an artificial anus or opening between the colon and skin surface for the escape of feces. The older term *colotomy*

has been succeeded by the more precise *colostomy* which is derived from the two Greek words *κόλον* (colon) and *στόμα* (mouth or aperture).

Two centuries ago Littré suggested the advisability of opening the sigmoid flexure in the case of infants born with an imperforate anus. In 1796, Callisen proposed extraperitoneal lumbar colostomy which generally bears Amussat's name, as he established the method some fifty years

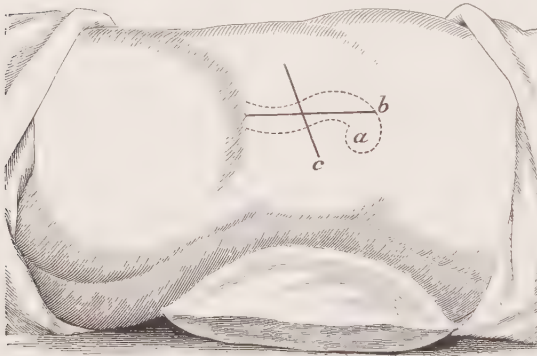


FIG. 391.—LINE OF INCISION IN LUMBAR COLOSTOMY. (Bryant.)

later, as a practical surgical procedure. With the advent of antiseptic surgery, fear of opening the peritoneal cavity disappeared and abdominal practically displaced lumbar colostomy.

Due to the writings of Herbert Allingham, Cripps and Reeves, inguinal colostomy was first adopted in England. Allingham showed that in the majority of cases it is impossible to open the colon through the lumbar region without entering the peritoneal cavity. According to Treves, the ascending colon possesses a distinct mesentery in 26 per cent of cases and the descending colon in 36 per cent, an insurmountable bar to extraperitoneal colostomy. When the mesocolon is

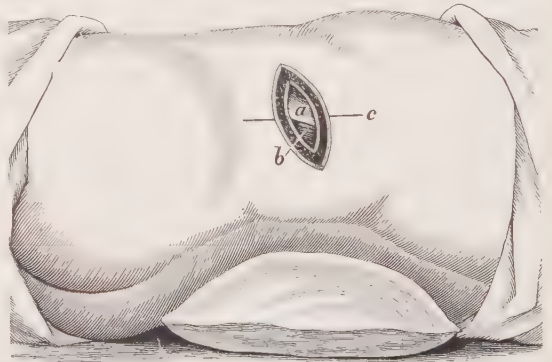


FIG. 392.—LUMBAR COLOSTOMY.

Transversalis fascia incised and subserous fat pushed aside, exposing colon above and quadratus-lumborum muscle below. (Bryant.)

absent or so short that its leaves can be separated, access may be obtained without invading the peritoneum. Again, the operation is rendered difficult owing to the limited operative field and the depth of the wound, especially in the obese; displacements of the colon, and anomalies of the ureter or kidney. At present, the only two indications for lumbar colostomy are incurable disease of the sigmoid, precluding its use for an artificial anus; or great distention of the bowel due to obstruction. The simpler and more efficient procedure for the former is transverse colostomy; and for the latter, cecostomy.

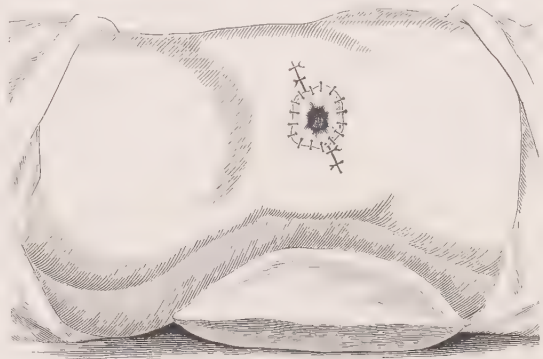


FIG. 393.—LUMBAR COLOSTOMY COMPLETED.
(Bryant.)

ABDOMINAL COLOSTOMY

The advantages of abdominal over lumbar colostomy are: (1) It is more easily and quickly performed; (2) there is less danger of infection in the shallower wound; (3) it gives an opportunity for abdominal exploration which is of the greatest importance in many of the cases requiring an artificial anus; (4) the site of the stoma is more convenient and comfortable for the patient; (5) closure can be accomplished more readily than when the artificial anus is in the lumbar region, and (6) the mortality is lower than in lumbar colostomy.

Abdominal colostomy is either *temporary* or *permanent*.

Temporary colostomy is employed with increasing frequency in the treatment of inflammatory conditions of the colon, sigmoid and rectum; in low wounds of the pelvic colon or rectum; strictures of the pelvic colon and certain extensive strictures of the rectum complicated by fistulæ; in complicated fistulæ between the intestines and urinary organs as sigmoidovesical fistula in diverticulitis of the pelvic colon; in certain types of prolapse; in imperforate anus; in multiple polyposis of the colon; as the preliminary step in excision or resection of the terminal bowel for malignant disease, and in certain cases before implanting radium into a cancer of the rectum.

Permanent colostomy is established in inoperable strictures or neoplasms of the colon or rectum; in cases where it is impossible to reestablish bowel continuity after resection of the diseased segment, and where the sphincters and entire anus have been sacrificed in amputation of the rectum for cancer, resulting in incontinence.

Some surgeons advocate a permanent artificial anus in all cases of cancer of the sigmoid and rectum whether excision is done or not. As colostomy does not appreciably retard the neoplastic growth, the operation may be deferred in inoperable cancer of the rectal ampulla until obstructive symptoms present, unless bleeding cannot be controlled by other methods. Wyard in a study of 450 cases of rectal carcinoma at the Cancer Hospital, London, concluded that colostomy did not prolong life, the duration being the same with or without colostomy. Presumably this estimate eliminates the cases of complete obstruction. Early colostomy is indicated in cancers involving the rectosigmoidal junc-

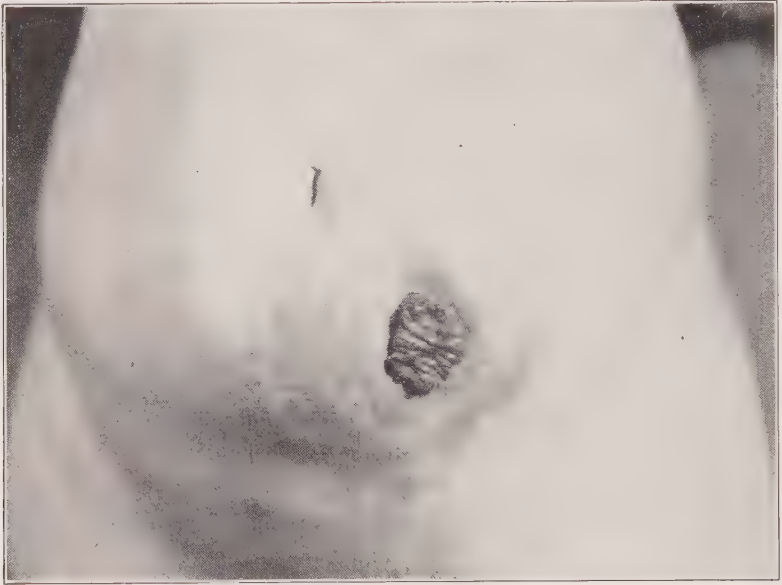


FIG. 394.—COLOSTOMY THROUGH LEFT RECTUS MUSCLE, ONE YEAR AFTER OPERATION.

No colostomy apparatus worn. Bowels, regulated by diet, act once or twice daily through the stoma.

ture, because of their tendency to circular infiltration and stenosis; and where involvement of the anal canal produces obstruction and torturing pain.

Patients object to colostomy on account of the annoying features inherent in an abnormally placed anus. Their objections are valid when the stoma is made in the cecum, the fluid contents of which cannot be controlled. However, when colostomy is established correctly in the sigmoid or transverse colon where the feces are formed, the patient usually experiences little difficulty apart from the time lost in attending to it night and morning. Many colostomized persons attend to their business and mingle in society without their associates being aware of their condition.

Mortality.—We must not confound the mortality of the operation with that of the disease for which the operation is done. Urgent colostomy upon pa-

tients *in extremis* naturally has a comparatively high mortality. In non-urgent cases, when the procedure is carried out under local or regional anesthesia, the mortality is practically nil. Cripps lost eleven of twenty-one completely obstructed patients, while only five died in 130 colostomies done before obstruction was complete. Including twenty-four of his own, Tuttle collected 255 cases with eight deaths, a mortality of 3.1 per cent. Colostomy was performed in seventy-eight of our cases and cecostomy in one. Our mortality has been almost wholly in the completely obstructed.

At present lumbar colostomy is so seldom performed that recent statistics are not available as regards its mortality. In 1896 Croley reported eighteen cases of lumbar colostomy with no deaths, all of the patients living from a few months to over two years after operation. The death rate in consecutive cases has been estimated at or above 12 per cent.

Temporary Colostomy.—

Temporary colostomy is made at a point in the colon above the seat of disease, with the object of diverting the fecal current while local treatment or some operative procedure is carried out on the bowel distal to the stoma. The site of the opening depends upon the location of

the disease and the kind of treatment. If the latter is to be local medication, the artificial anus should be placed as close to the diseased area as is consistent with its establishment in sound tissue; if operative procedures are to follow, it should be placed at such a distance above the lesion as not to interfere with the performance of an operation on a tumor or stricture and that sufficient healthy bowel remains below it through which, if possible, to reestablish bowel continuity. Thus, in some cases, the artificial anus should be made in the lower portion of the sigmoid, in others in its upper portion, and in still others in the transverse colon or cecum.

The essentials of a temporary colostomy are a free exit for the intestinal contents, absolute prevention of feces escaping into the distal segment by



FIG. 395.—INCISION IN INGUINAL COLOSTOMY.
Skin and subcutaneous fat drawn aside, exposing external oblique muscle.

the formation of an efficient spur, prevention of prolapse, and facility of closure, without too great risk, after its purpose has been served. A successful colostomy depends in large measure upon bringing the bowel through a short abdominal



FIG. 396.—INGUINAL COLOSTOMY.
Exposure and separation of the internal oblique muscle.

incision into which the bowel fits snugly without undue constriction of the circulation in the protruded knuckle. For this reason, in cases where the abdomen is to be explored, as in carcinoma, the primary incision is made through the right rectus muscle and if colostomy is decided upon it is established through a second incision on the left side.

Technic.—The patient is prepared as for laparotomy. If the abdomen is to be explored, general anesthesia is most satisfactory; otherwise local anesthesia, preceded three-quarters of an hour by morphin and atropin, is preferable.

RECTUS COLOSTOMY.—A vertical incision of $2\frac{1}{2}$ inches, or longer in fat subjects, is made through the center of the left *rectus* muscle, its upper end being slightly below the umbilicus. All bleeding vessels are tied. Then the peritoneum is incised in the same line, its edges caught with forceps, and drawn up through the wound to prevent its separation from the abdominal wall during the subsequent manipulations. With the table in moderate Trendelenburg position, the index and middle fingers of the right hand are passed to the left parietes, following the peritoneum down toward the midline. The first loop of large bowel encountered is the sigmoid. This is drawn into the wound and recognized by the longitudinal muscular bands and appendices epiploicæ. The sigmoid is drawn well out of the wound, if possible, and until its upper segment is taut. A glass

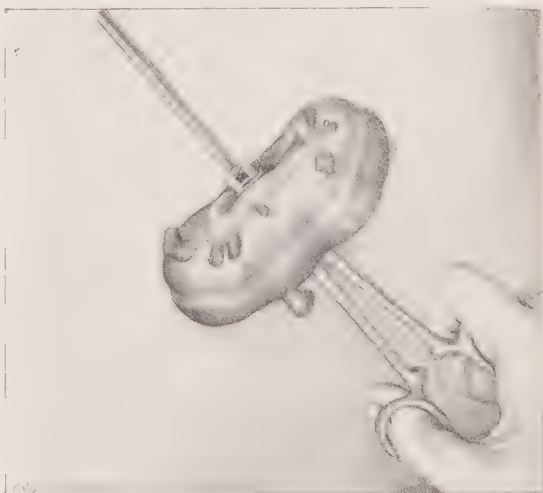


FIG. 397.—TEMPORARY INGUINAL COLOSTOMY.
Rod being passed through mesentery.

A glass

rod 4 inches long and $\frac{1}{4}$ inch in diameter is passed through an avascular area of the mesentery near the bowel. Excess gut is returned to the abdomen and the peritoneum attached to the bowel by a few interrupted sutures of fine catgut. The lower angle of the wound is closed snugly with silkworm-gut sutures so as to compress the distal loop against the glass rod. A single suture above and below the protruding bowel takes in the longitudinal muscular band and skin. It is unnecessary to suture the peritoneum to the skin, as Reclus has shown that this does not hasten union and produces a weaker adhesion of the gut to the abdominal wall. Appendices epiploicæ are ligated close to the intestine and ablated. The intestine is smeared with vaselin and gauze pads are placed beneath the glass rod, over the ends of which short pieces of rubber tubing are drawn to prevent the rod slipping out of place. A square of rubber tissue covers the gut to prevent adhesion to the gauze dressings which are placed around and over it. The dressings are retained in place by broad strips of adhesive applied transversely just above and below the protruding bowel.

The gut is not opened at this time, but great distention with gas may be relieved by tying a catheter in the proximal loop by a purse-string suture. Sufficient adhesions



FIG. 398.—TEMPORARY INGUINAL COLOSTOMY.
Gut supported on rod and sutures in position.

have formed so that if necessary the bowel may be opened safely eight hours after operation. Usually, however, gas passes over the spur and it is better to wait three or four days before making the opening. This is accomplished in bed, best by an electric cautery and without anesthesia as the gut is insensitive. The longitudinal portion of the incision extends from the upper angle of the wound through the muscular band opposite the mesentery to $\frac{1}{2}$ inch below the supporting rod. At this point the bowel is divided transversely for two-thirds of its circumference. The triangular flaps in the upper segment roll outward. The transverse flap in the lower segment falls inward, practically closing the lower aperture. This prevents quite effectually the escape of feces into the distal segment. The advantage of this method of Tuttle is that no portion of the intestine is sacrificed and, when advisable, the artificial stoma can be closed by simply suturing together the edges of the T-shaped incision without entering the peritoneal cavity. By simply raising the transverse flap, opportunity is furnished for irrigation and treatment of the lower segment.

The glass rod is removed in a week or ten days; that is, when the wound is firmly healed.

Another valuable feature of this method is that the temporary can be readily converted into a permanent artificial anus. The surrounding skin is protected with wet gauze pads and the protruding edges of bowel are ablated with the cautery to within 1 centimeter of the skin. No anesthetic is necessary for this procedure and the cautery controls bleeding. The posterior wall of the gut which is above the glass rod is sensitive because of the nerves

contained in its mesentery. It may remain as a permanent spur. Otherwise it is infiltrated with novocain solution before transverse division. The mesenteric vessels, which here bleed freely, are caught and tied. Then the mucosa is united transversely by a few interrupted sutures of chromic catgut, forming an effective spur. The wound is dressed with vaselin gauze.

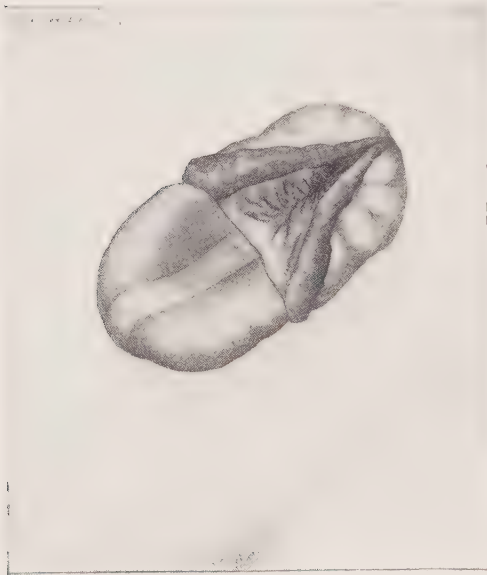


FIG. 399.—TEMPORARY INGUINAL COLOSTOMY.
INCISION FOR OPENING THE GUT.

INGUINAL COLOSTOMY (MAYDL-RECLUS).—The skin incision of left inguinal colostomy is approximately $2\frac{1}{2}$ inches in length, beginning 1 inch above and $1\frac{1}{2}$ inches internal to the anterior superior spine and extending downward parallel to Poupart's ligament. In order to preserve the constricting function of the muscles in control of the bowel, the external oblique and internal

oblique muscles and fascia are separated in the line of their fibers. The transversalis fascia and peritoneum are cut in line with the skin incision. The sigmoid is drawn out and treated as in rectus colostomy.

These are the quickest, simplest and most satisfactory methods of performing colostomy. An artificial opening through the rectus is superior to an inguinal opening, in that it is easier to cleanse, no bony structures interfere with the colostomy cup when a receptacle is worn and the muscle aids greatly in voluntary control of the stoma.

Bodine united the proximal and distal legs of the sigmoid with fine sutures for a distance of about 2 inches on each side of the mesentery, thus forming an effectual spur. This is practically the same procedure as a Mikulicz operation for resection of the sigmoid (see Figs. 382-388). This method is naturally of limited application, being restricted to cases with a long free sigmoid loop.

Permanent Colostomy.—*Technic.*—Witzel, Weir, Bailey and Tuttle devised methods of establishing permanent colostomy with the purpose of fecal control. All of these methods begin with the usual incision for inguinal colostomy and then bring the bowel out through the muscles at different levels, finally establishing the stoma in a separate skin incision just above or below Poupart's ligament. The angulation of the bowel thus produced is reported as being very effective in fecal control. In the majority of cases, however, in time the gut straightens out and control is no better than in the simpler method of bringing the bowel directly through the abdominal wall. Moreover, the patient is subjected to the annoyance of an inconveniently placed stoma.

This method can be practiced only in cases where the gut can be raised at least 2 inches above the skin surface.

TUTTLE'S METHOD.—The sigmoid is drawn out through the ordinary incision for inguinal colostomy and a traction tape passed around it through a small opening made in the mesentery. The internal oblique is split 2 centimeters laterally and a canal is then made downward between the external oblique and skin for a distance of about 2 inches, opening through a skin incision just above Poupart's ligament. Through the slit and canal thus formed the segment is brought out through the lower skin incision where it

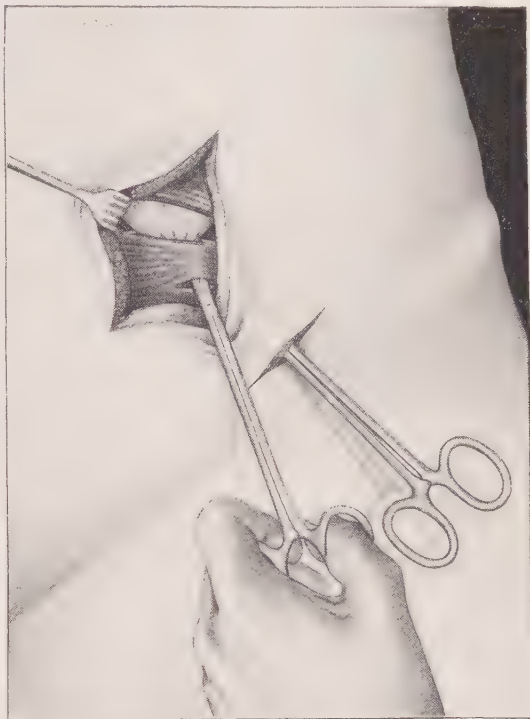


FIG. 400.—PERMANENT COLOSTOMY (TUTTLE'S METHOD).

The gut is being dragged through the split internal oblique and then through the subcutaneous canal.

is fixed by passing a glass rod through the opening in the mesentery, or by suturing it to the margins of the wound. The abdominal wound is then closed and sealed to prevent its infection from the colostomy. After the protruding bowel is ablated on about the tenth day, a double-barreled aperture presents. A truss or compress placed over the bowel where it rests upon the resisting external oblique, occludes its caliber and secures efficient control. In five of seven cases in which Tuttle practiced this method, continence was so complete that no compression apparatus was necessary.

TRANSVERSE COLOSTOMY.—Transverse colostomy is indicated for disease or tumors of the sigmoid; also rarely when the sigmoid, because of a very short mesentery, cannot be utilized for colostomy. Diversion of the fecal current at a point in the colon where its contents are formed gives transverse colostomy obvious advantages over cecostomy. There is usually ample length of colon, but a very short gastrocolic omentum may contra-indicate transverse

colostomy, as fixation of the bowel may hamper gastric motility, especially if the stomach is small.

The abdomen is opened through a vertical incision at the middle of the left rectus muscle, extending downward about 2 inches from a point slightly above the umbilicus. The great omentum is drawn out of the wound until the transverse colon presents. A knuckle of gut as near the splenic flexure as can be utilized without undue tension, is raised by two fingers against the great omentum which is opened in an avascular area; the knuckle is pushed through this opening and a glass rod is passed through an avascular area beneath it. The entire omentum is returned to the abdomen where, in its normal position, it protects the perito-



FIG. 401.—PERMANENT COLOSTOMY BY TUTTLE'S METHOD COMPLETED.

neum from infection and surrounds the protruded knuckle which is supported on the rod. The rod rests vertically upon the abdomen over the wound. The angles of the skin incision are closed by silkworm-gut sutures.

As symptoms of obstruction may appear earlier after transverse than sigmoid colostomy, the bowel usually must be opened within twenty-four to thirty-six hours. This can be done safely as the omental shield effectively protects the peritoneal cavity against invasion in the rare event of infection of the wound.

Control after Colostomy.—A properly performed colostomy usually functions well a few weeks after operation. Infection of the wound may weaken the abdominal wall support which predisposes to prolapse of the mucosa or bowel proper through the stoma and poor control. Patients with good muscu-

lar development and no malignant growth usually have good control; the aged, feeble patient with an inoperable neoplasm is less favorable.

It is important for the opening to be of sufficient size for free exit of the feces. Among the patients admitted to the New York City Cancer Institute with colostomy, the stoma in several consisted of a fibrous ring which barely admitted the index finger. The ensuing stasis resulted in constant dribbling of feces which was relieved only by a revision of the colostomy.

Colostomized patients should cultivate a twelve- or twenty-four-hour habit of bowel evacuation, the diet being the chief regulator. Articles which cause diarrhea are omitted from the diet and laxatives are avoided, if possible. In some cases a slight cramp signals an impending bowel action; in others the movement is without sensation. Some patients wash out the colon proximal to the stoma once daily, thus preventing leakage.

When continence is good, the simplest apparatus to wear is an abdominal belt, having a pad of rubber opposite the opening, beneath which a small pad of gauze is placed over the stoma. In cases where this method is not satisfactory, a colostomy pouch is employed. Several patterns are made, but we have found the Delatour model the simplest and most sanitary receptacle. It consists of a hard rubber cup to surround the opening and a detachable rubber bag to collect the intestinal discharge. The flexible spring maintains the vulcanized rubber cup in uniform contact with the peristomal skin, there being no leakage with changes of position.

In an analysis of fifty cases of colostomy, Edwards estimated the degree of control over the artificial opening to be: Excellent in seventeen (34 per cent), good in twenty-three (46 per cent), poor in six (12 per cent), and bad in four (8 per cent) patients.

Cecostomy.—Anatomical conditions usually make it difficult to form a permanent colostomy on the right side after the Madyt-Reclus method. Fortunately it is seldom necessary. It should always be avoided, if possible, as the uncontrollable fluid feces irritate and excoriate the skin.

Cecostomy is performed when it is impossible to make the opening in the sigmoid or transverse colon; when a stoma so made is not above the obstructive lesion, and as a means of irrigating the entire colon in all forms of colitis, especially ulcerative.

The practical methods of performing cecostomy are similar in technic to

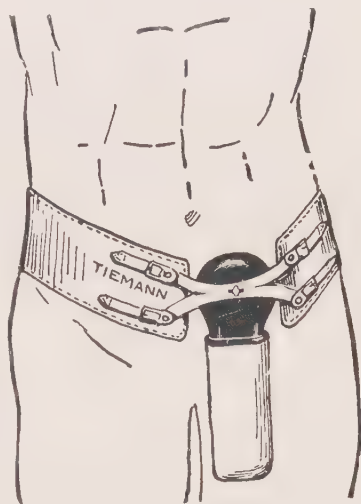


FIG. 402.—DELA TOUR COLOSTOMY APPARATUS WITH RECEPTACLE IN POSITION.

gastrostomy after the procedures of Senn, Kader or Witzel. All of them are valvular and tend to close spontaneously, which is in marked contrast to an ordinary cecostomy in which it is difficult to control the opening and later to close it.

Valvular Cecostomy (Kader-Gibson).—The cecum is drawn through a short intermuscular incision 2 inches above and parallel to Poupart's ligament. The protruding knuckle is protected with gauze pads and an opening made in its anterior muscular band just large enough to admit a No. 18 F. soft rubber catheter. The catheter is inserted 2 inches and the bowel inverted about it by three tiers of seromuscular sutures, thus forming an intraluminal projection. The ends of the last tier of sutures are left long and passed through the peritoneum and fascia at the margin of the abdominal wound; when tied, they close the deep portion of the wound and coapt cecum to the abdominal wall. The rest of the wound is closed on each side of the tube. Tiers of purse-string sutures may be used to invert the cecum around the tube as in a Senn gastrostomy. The catheter is left in place ten days or more, until the wound is healed. Then it is removed and reinserted as necessary for irrigations. A small gauze pad controls the slight fecal fistula (see Figs. 216, 217).

Witzel Cecostomy.—This is a simple, safe and efficient form of cecostomy, which rivals the above methods in control of the fecal contents but technically is more difficult and requires more time for its execution. The abdomen is opened by an oblique incision of 3 inches in the right iliac region, its center on a line extending from the anterior superior spine to the umbilicus. The cecum is drawn gently into the wound for about two-thirds of its circumference where it is fixed by passing a guide suture at each angle of the wound. The peritoneal cavity is then closed by a continuous suture of chromicized gut or Pagenstecher linen which unites the seromuscular coats of the cecum to the peritoneum and muscle or aponeurosis for the entire circumference of the wound. These sutures are so introduced as to bring a rather broad surface of serosa and peritoneum in apposition. The two guide sutures first introduced are now tied and the margins of the wound protected with iodoform gauze. The bowel is opened $\frac{3}{4}$ inch from the lower angle of the wound by a longitudinal incision just large enough to admit a No. 20 F. catheter. This is introduced 2 or 3 inches and fixed by a single catgut suture passing through one side of the tube and all coats of the gut. The tube, laid against the cecal wall, is buried in a canal by uniting the summits of the folds of the cecum on each side over the tube by interrupted chromic gut sutures. About 2 inches of the tube are thus enclosed. The rest of the abdominal wound is sutured in layers, space being left for a small iodoform gauze drain around the tube (see Fig. 218).

The tube serves as a vent for gas, drainage of fluid intestinal contents, and for irrigation of the colon. After the wound has healed, in approximately ten days, the tube may be taken out and replaced as indicated for treatment, only a small pad being worn to take up the slight leakage. When the purposes

for which the cecostomy was established have been accomplished, the opening usually closes spontaneously.

Closure of Colostomy Opening.—The method of closing an artificial anus is either extraperitoneal or intraperitoneal, depending largely upon the manner in which it was originally made. In general the openings are of two kinds:

(1) A large intestinal opening, at the margin of which the mucosa is continuous with the skin. There is no spur. (2) The two bowel segments meet in an acute angle at the surface. A spur at approximately the skin level deflects the intestinal contents to the surface.

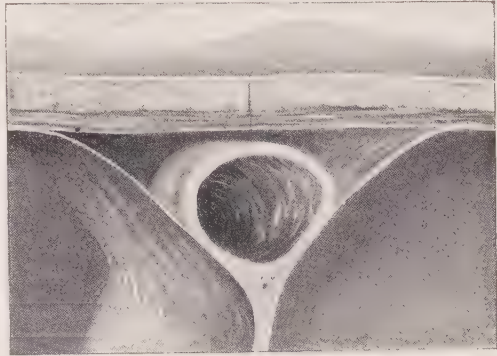


FIG. 403.—CROSS SECTION AFTER EXTRAPERITONEAL CLOSURE OF ARTIFICIAL ANUS.

Extraperitoneal Closure.—The bowel above the stoma should be thoroughly emptied by castor oil or compound licorice powder given on three successive days before operation and the distal loop irrigated daily. The patient is then constipated by diet and peristalsis is arrested by opium during the twenty-four hours before operation. When the sigmoid or transverse colon, supported on a glass rod, has been opened only on the surface opposite the mesentery, no portion is sacrificed and the mucosa along the mesenteric attachment remains intact.

TECHNIC.—The skin and mucosa are rendered as sterile as possible by the free application of tincture of iodine. The edge of the mucosa with a very narrow margin of adjacent skin is dissected free. The edges of the opening are freshened by cutting away the freed skin and a narrow margin of bowel around the stoma.

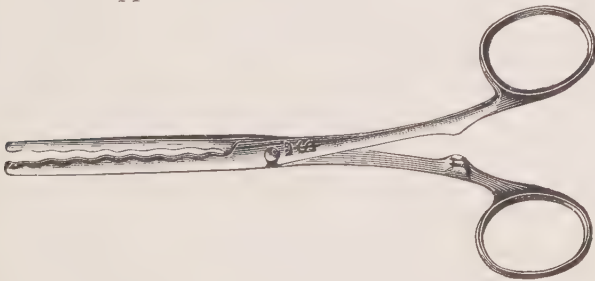


FIG. 404.—COLLING'S LONG FORCEPS FOR CRUSHING COLOSTOMY SPUR.

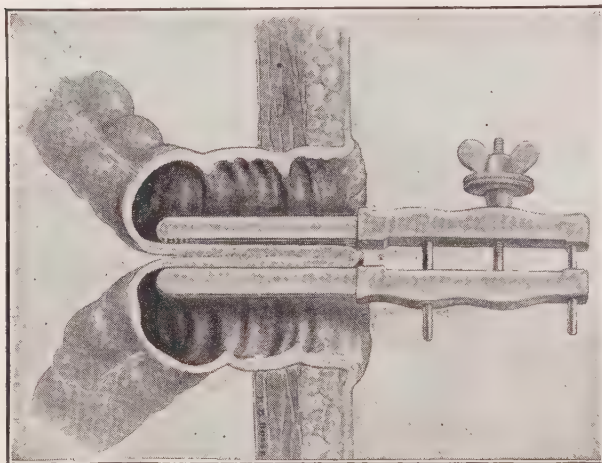
The wound in the colon is closed by a double row of continuous chromicized catgut sutures inserted transversely; the first row passes through all coats of the bowel; the second is seromuscular to invert the first. After the opening is thus closed, the bowel is dissected free from the abdominal wall down to the peritoneum, which is not opened but carefully stripped from the abdominal wall all around the artificial anus a distance of 1 inch or more, at least a sufficient distance to receive the colon without obstructive kinking of its lumen. This loosening

provides a hammock of peritoneum into which the closed gut is displaced beneath the abdominal wall. The latter is then closed by silkworm sutures through all its layers. Should leakage occur from the closed stoma it will be in the subperitoneal tissues and point externally.

The same method may be employed when the bowel has been completely divided. After freshening the bowel ends, they are united by suture and buried in the extraperitoneal pocket.

When the colostomy was established by the Mikulicz or similar method, in which the two colonic legs are sutured together about 2 inches below the

abdominal wall, extraperitoneal closure may also be done. First it is essential to cut away the spur so that the upper communicates freely with the lower limb of the colon. An enterotome, or stout forceps with a long jaw, is used. Under guidance of the fingers, a blade of the instrument is passed down on each side of the spur to its base—a distance of $1\frac{1}{2}$ or 2 inches—where it is clamped. The blades are tightened daily until they cut through by necrosis



Kny-Scheerer Corp., N. Y.

FIG. 405.—STETTEN COLOSTOMY SPUR CRUSHER.
(Courtesy *Am. J. Surg.*, Oct., 1928.)

of tissue in four to six days. If the spur has not been completely destroyed, operative closure should not be attempted until it is obliterated by reapplying the clamp at a deeper level. After this, feces usually pass both by the rectum and through the artificial anus. The latter may close spontaneously in a few weeks or months, or require closure by the method described above. Although the intestine is anchored and its lumen somewhat narrowed by this procedure, yet the results are quite satisfactory.

Intraperitoneal Closure.—In cases where extraperitoneal methods of closure fail because of extensive loss of bowel substance, or where, after destruction of the spur, closure cannot be effected, the most satisfactory method is resection of the bowel segment involved in the fistula.

In some cases where the first operation for extraperitoneal closure has failed, a second attempt is successful. As there is practically no risk involved a second trial should be made before resorting to the intraperitoneal method. The latter involves opening the peritoneal cavity and may be more dangerous than ordinary resection of the gut. This is due to the presence of adhesions and the difficulty of obtaining bowel ends completely covered with peritoneum

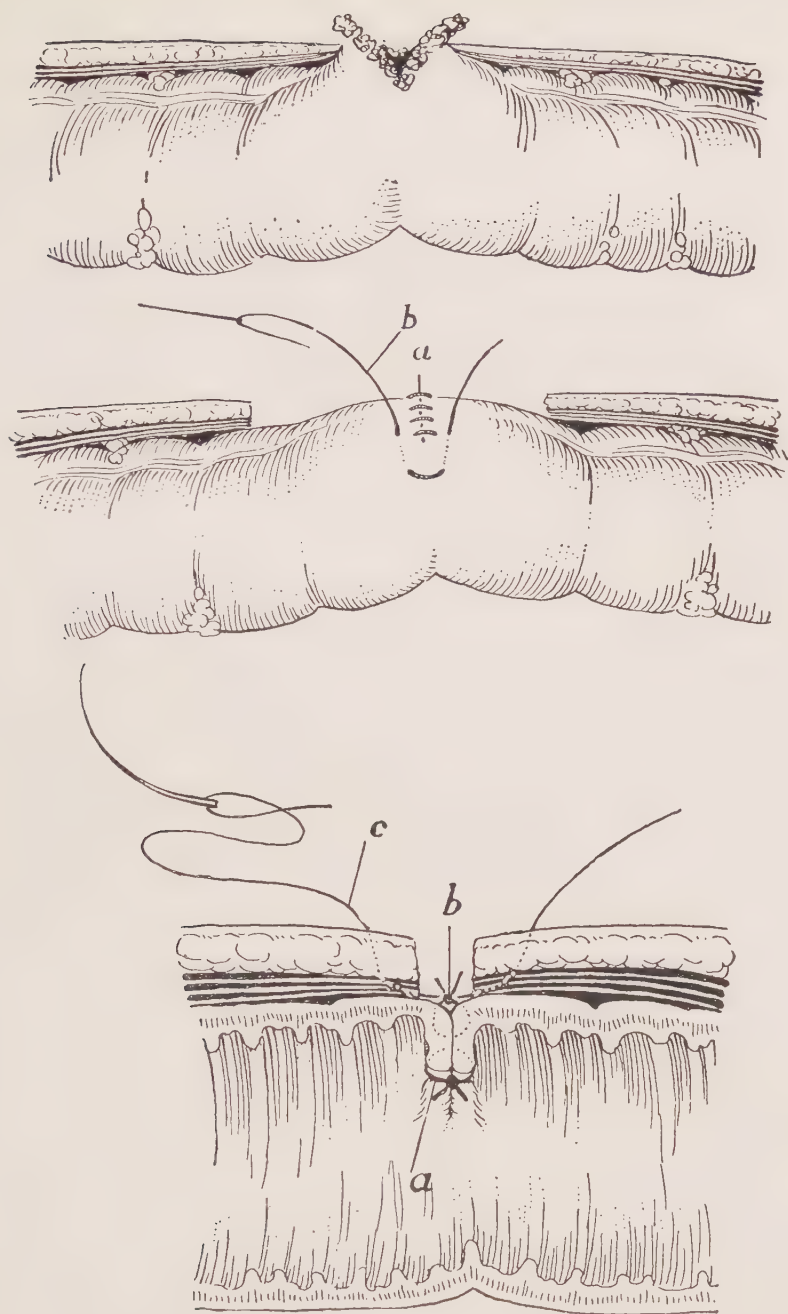


FIG. 406.—EXTRAPERITONEAL CLOSURE OF COLOSTOMY STOMA.

The intestine is separated from its attachment to the abdominal wall so as to expose its peritoneal surface. The lower leg is then pulled upward and the upper leg downward. If the peritoneum is slightly opened for this procedure, its edges are sutured by fine catgut stitches to the freed bowel. Interrupted chromicized gut stitches (a) are taken through the entire intestinal wall at the upper and lower edges of the stoma and tied with their knots inside the intestinal lumen. This row is then reinforced by Lembert stitches (b). The edges of the abdominal wall are then approximated by silkworm gut stitches (c) leaving provision for possible leakage. (Courtesy of Charles N. Dowd and permission of *Annals of Surgery*, December, 1920, J. B. Lippincott & Co., Philadelphia.)

without sacrificing considerable portions of the intestines. Consequently a sufficient length of gut may not always be available for anastomosis.

The exposed mucosa is dried and swabbed freely with tincture of iodine. Then it may sometimes be freed by dissection and temporarily closed over the opening by sutures. An oval skin incision is carried around the stoma and deepened on one side well away from the bowel until the abdominal cavity is opened. Through this peritoneal opening one finger is introduced as a guide and under good exposure the involved portion of gut with the fistula is liberated and withdrawn from the abdomen. Closure is then effected by one of two methods. If, after dissecting away unhealthy tissue, only a hole is left, a wedge-shaped section of gut is cut out with its apex toward the mesentery in order to insure a good blood supply to the joined edges on the side opposite the mesentery. The first row of chromicized catgut sutures pierces all coats of the bowel; the second row of seromuscular sutures inverts the first row. After replacing the cleansed bowel within the abdomen, gloves and instruments are changed. A rubber-tissue drain is inserted to the point of bowel closure and the abdominal incision is sutured on each side of the drain. The drain is removed in forty-eight hours.

In some cases closure can be effected only by resecting several inches of bowel with end-to-end anastomosis by the usual methods.

Postoperative Treatment.—To prevent tension on the intestinal sutures, liquid stools are obtained daily by giving liquid petrolatum at night, small doses of saline cathartics in the morning and by very gentle irrigation of the rectum twice daily. Another means of reducing intraluminal pressure and rendering the operation safer is coincident establishment of a valvular cecostomy.

With improved technic, the mortality from closure of these openings is diminishing. The results in forty-four collected cases were: Successful closure, twenty-four; first operation failed, nine; repeated operations failed, six; operative deaths, five. The operation was performed upon eighteen patients at DeLore's Clinic (Lyons) without mortality.

REFERENCES

- CROLEY. *Tr. Acad. Med. Ireland*, 1896.
EDWARDS, F. S. *Brit. M. J.*, Lond., May 26, 1917.
GIBSON, C. L. *Med. Rec.*, N. Y., 1901, Vol. 1.
STETTEN, DeWitt. *Am. J. Surg.*, N. Y., Oct., 1928.
WYARD, S. *Brit. M. J.*, Lond., Jan. 31, 1924.

CHAPTER XXXIII

RECTAL INCONTINENCE

Physicians are familiar with rectal incontinence as a terminal phenomenon of infectious diseases and general sepsis, and as a symptom in certain lesions of the central nervous system. Patients who consult surgeons for this distressing condition are of another order and are the group under discussion. At the outset, it may be said that complete normal continence is dependent on the integrity of the external sphincter muscle and its nerve supply. The delicate sensibility of the mucocutaneous tissue overlying the external sphincter differentiates between flatus and liquid, which, by their distention of the anal canal, excite the muscle sense possessed by the sphincter. Reflex or voluntary contraction then comes into play and the orifice is controlled. Integrity of the internal sphincter gives warning of the pressure of gas or feces in the rectum; but, as it is an involuntary muscle, it has the power of only partially controlling the passage. Therefore, integrity of the internal sphincter alone is not sufficient for complete continence. The degree of incontinence varies from slight or partial to complete, in which the patient has neither knowledge of, nor control over, his evacuations.

Etiology.—Apart from those due to nerve lesions and vices, such as sodomy, cases of incontinence may be grouped under three categories:

Those due to anorectal pathology, cases caused by accident or injury, and those resulting from operation. Partial incontinence occurs at times when the external

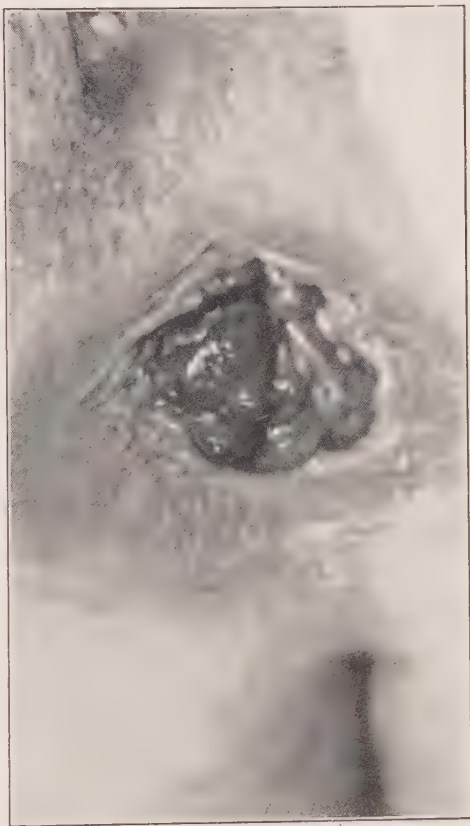


FIG. 407.—PATULOUS ANUS IN A WOMAN, AGED TWENTY-SIX, FOLLOWING EXCISION OF A PORTION OF THE EXTERNAL SPHINCTER MUSCLE DURING HEMORRHOIDECTOMY.

sphincter and its nerve supply are intact. Frequently in acute diarrhea and dysentery, the urgent desire to stool can be restrained only for a short period.

Prolapsed hemorrhoids may cause an annoying partial incontinence.

Prolapse of the rectum, especially if it be large, causes chronic dilatation and atony of the sphincters and a more or less patulous anus. When the bowel is constantly protruded, the feces are passed unconsciously as they do not impinge on the sensitive anal canal. In the aged, the sphincters are especially prone to give way under these conditions.

Stricture of the rectum has incontinence as a symptom. Its degree is in proportion to the involvement of the anal canal in the stricture.

Rupture of the perineum during parturition and accidental injury of the sphincters, as by impalement, may result in incontinence.

Incontinence due to operations accounts for many of the cases encountered. This may happen when the sphincter is intact; for instance, after a Whitehead operation in which there has been delayed healing and the sphincter, caught in the scar tissue, cannot contract. Operators inexperienced in the Whitehead technic have removed large sections of the sphincter with resultant incontinence; or sacrificed the sensory tactile nerves in this region, with consequent loss of appreciation of the presence of feces and partial incontinence. Too

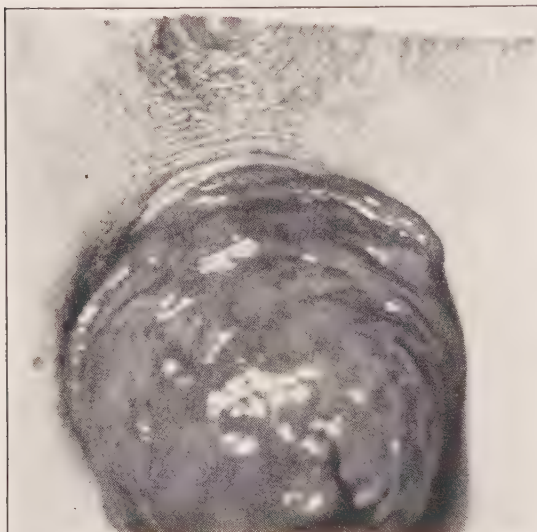


FIG. 408.—COMPLETE PROLAPSE OF THE RECTUM IN THE SAME CASE AS FIG. 407.

Excision of longitudinal strips of mucosa by ligature and clamp and cauterization and suture of the severed ends of the sphincter overcame the prolapse and gave a good functional result.

forceful dilation of the sphincters, especially in the aged, to relieve anal fissure, or preliminary to hemorrhoidectomy may result in rupture of the muscle and partial incontinence. Incontinence following operations for fistula is usually due to oblique division of the sphincter, instead of severance at right angles to its fibers, and formation of too long a bridge of scar tissue between the cut ends. Incontinence should almost never follow a properly performed operation for fistula. Complete division of the sphincter at two or more points at the same time inevitably results in incontinence. In amputation of the rectum for malignant disease involving the anus, naturally the sphincters are sacrificed. A preliminary permanent colostomy will usually give better control than a perineal anus without sphincters.

Diagnosis.—A complete history will usually indicate the causal group to which the case belongs. Inspection of the anus may show prolapsing hemorrhoids or the significant operative scar, and if the patient now contracts, there is puckering of the skin over the active portion of remaining sphincter, or dimpling may mark the site of its severed ends. Now, with the finger introduced into the

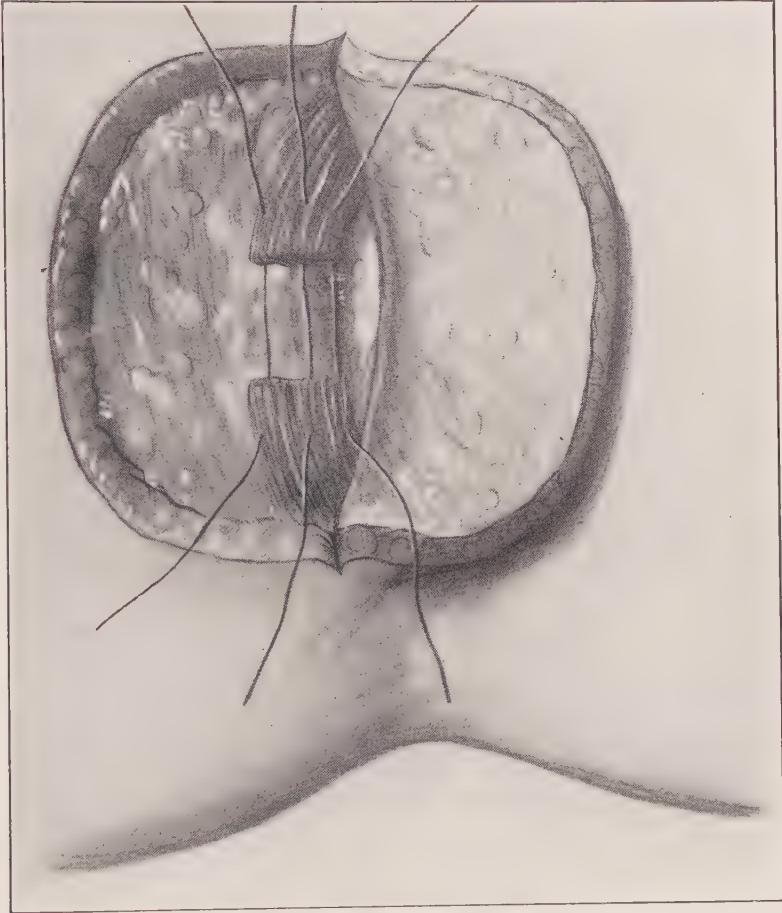


FIG. 409.—REPAIR OF EXTERNAL SPHINCTER MUSCLE FOR INCONTINENCE.

Crescentic flap of perianal skin reflected inward; retracted muscle ends exposed and cut transversely; sutures passed.

rectum while the patient contracts, the presence of the muscle, its efficiency and the segment in the anal ring unaffected by the contraction of the muscle can all be determined.

A patulous anus is suggestive of incontinence due to prolapse of the rectum, to be confirmed by having the patient protrude the bowel while straining in the squatting position. It should also be remembered that patulous anus may be

associated with spinal cord disease, notably *tabes dorsalis*, in some cases of which it is one of the earliest symptoms, and in which operation is contra-indicated.

Treatment.—Cases due to prolapsing piles or *procidentia recti* are relieved by appropriate treatment of these conditions. When incontinence is due to a rectal stricture, the treatment is for relief or cure of the stricture. Stimulation

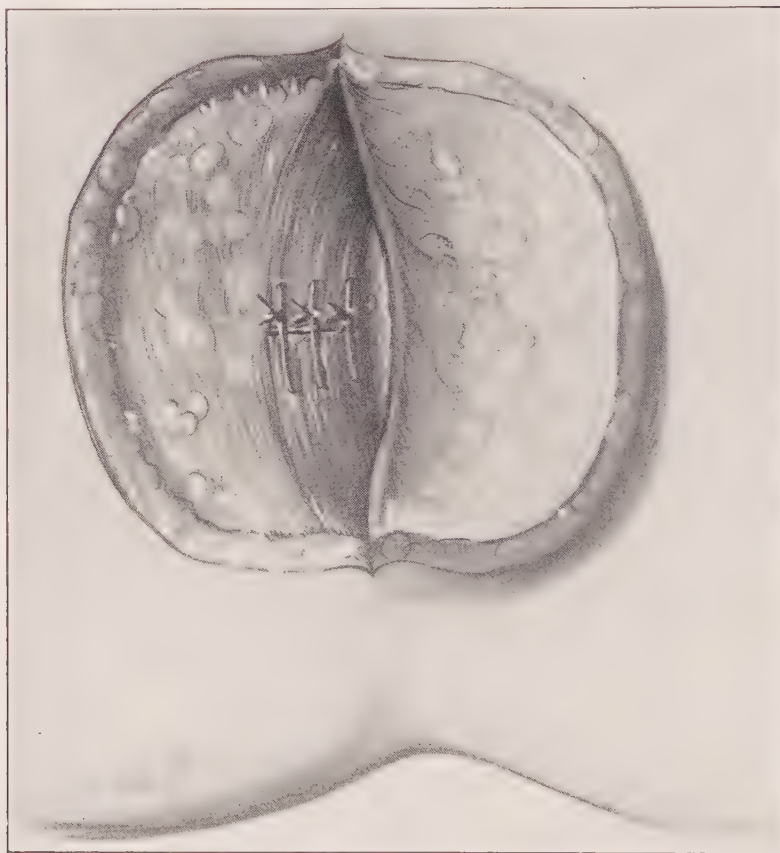


FIG. 410.—REPAIR OF EXTERNAL SPHINCTER.

Same case as Fig. 409. Sutures tied, approximating muscle ends.

of the sphincter by the galvanic current has been recommended by some writers. Evidently its field of usefulness would be restricted largely to cases dependent upon a lesion of the central nervous system, or to exercise an atonic sphincter after the causal factor has been corrected. A Wales bougie, passed occasionally, may loosen up the fibrous tissue fixing the muscle, as in cases of incontinence following a Whitehead operation.

In the majority of cases an operation is necessary. Every case must be considered by itself. The operation must be planned carefully to fit the individual

case. Scrupulous care in its execution is essential. Infection is apt to mar the best surgical effort. Practically all cases are improved by operation and, in many cases, function is completely restored.

Surgical Treatment.—Careful preparation of the patient for operation is essential to avoid soiling the operative field during or for some days after the operation. Buried sutures should be as few as requisite and of fine chromicized catgut, carried on a round-bodied needle to prevent cutting of tissues. Tension sutures of silkworm gut are passed deep to the wound, obliterating all dead spaces, and tied over iodoform gauze. Perfect hemostasis is essential. The lithotomy position is preferable and a good light important.

The plastic operation has for its ideal the isolation of the severed ends of the sphincter muscle and their accurate apposition by sutures. Unfortunately the majority of these cases are of long standing. Meanwhile the cut ends of the muscle have naturally retracted, aided by the action of the closely interwoven fibers of the levator ani, which tends to draw them away from the anal canal. As a result a triangular gap is formed, with its apex directed outward. Moreover, when there has been extensive chronic infection, the sphincter muscle may have so degenerated into fibrous tissue that scarcely any of its fibers can be identified.

Type operations only will be described, variations from which the surgeon will adopt for the individual case.

OPERATION WHEN MUSCLE IS PRESENT AND GAP NARROW.—By inspection and palpation the respective sites of the severed ends of the muscle are determined. A semilunar incision, convex outward, divides the skin beyond the ends of the retracted muscle. The skin flap is elevated by dissection well beneath the anal canal, taking care not to buttonhole the flap. Scar tissue separating the ends of the muscle is dissected out, the muscle freed slightly on each side and so trimmed that the ends may be accurately united with interrupted sutures of chromicized catgut. After obtaining perfect hemostasis the skin flap is closed with fine silkworm-gut sutures.

The final step in the operation is the introduction of a suture to relieve tension on the sutured ends of the sphincter. A heavy strand of silkworm gut on a large curved needle is passed deeply through the sphincter, entering and emerging beyond the ends of the wound, and is tied over a gauze pad. A gauze com-

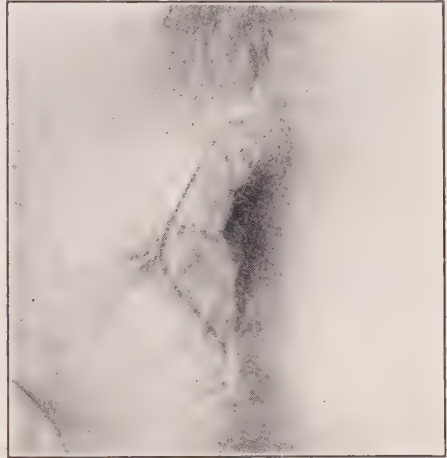


FIG. 411.—REPAIR OF EXTERNAL SPHINCTER FOR INCONTINENCE FOLLOWING FISTULECTOMY.

Linear scar and appearance three months after operation. Excellent result. Male, aged forty-four.

press over the wound is retained by broad strips of adhesive plaster applied transversely, which gives needed support to the parts.

The dressing is changed in forty-eight hours and daily thereafter. The bowels are confined for eight days and then moved by enemas of warm olive or cotton-seed oil. The patient remains in bed one week longer. Primary union and a good functional result are anticipated. If signs of infection develop the wound should be partly opened at once and a narrow rubber-tissue drain inserted. Infection is usually superficial and although it may delay the healing, it does not materially affect the result.

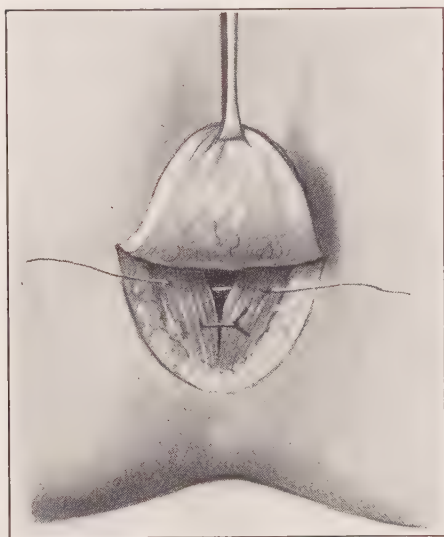


FIG. 412.—PATULOUS ANUS DUE TO RELAXED SPHINCTER.

The posterior ends of the intact sphincter are exposed through a semilunar incision and united by sutures passed transversely.

closed by silkworm sutures. The dressing and postoperative care are the same as previously described.

PATULOUS ANUS.—In this condition, the sphincter muscle is present all around the anus, but lax and not perfectly efficient. More or less constant escape of fecal material in small amounts so annoy the patient that he seeks surgical relief. Apart from the cases associated with lesions of the central nervous system, overstretching the sphincters is the chief cause.

Operation to narrow the anal orifice is performed by making a semilunar incision of the skin posterior to the anus and dissecting up the flap until the sphincter is exposed. The angle, made by the normal division of the muscle to surround the anal canal, is closed by sutures of fine chromicized catgut, passed transversely. Thus the anal orifice is reduced considerably in circumference (Fig. 412).

OPERATION WHEN MUSCLE IS ATROPHIED AND GAP BROAD.—This condition may follow operation on an extensive fistula in which considerable infection was present. The sphincter ends are separated widely and matted in the cicatricial tissue. In fact, the muscle may be atrophied and fibrosed beyond recognition. In such cases, the object of operation is to improve the condition by obliteration of the gap or sulcus. The scar tissue, corresponding to the gap, is dissected out. It is important to carry the dissection to or beyond the depth of the anal deficiency. The parts are approximated by several buried sutures of chromicized catgut, each taking a good bite through firm tissue. The skin is

CHAPTER XXXIV

WOUNDS, INJURIES AND RUPTURE OF THE RECTUM AND SIGMOID

Accidental wounds and injuries of the anus and rectum are comparatively infrequent, owing to their protected anatomical position between the folds of the buttocks and within the bony pelvic girdle. However, the complications attending such injuries, particularly when involving the upper rectum, sigmoid and abdominal viscera, are usually of a serious nature and demand careful judgment in their treatment. The various wounds encountered in these parts may be classified as contused, lacerated, incised, punctured and gunshot.

One of the most common *contusions* of the rectum results from protracted engagement of the fetal head in the birth canal during labor. This is frequently associated with laceration of the external sphincter and may be followed by stricture. Less commonly the anus and rectum may be contused by the continued use of ill-fitting pessaries, prolonged retention of foreign bodies in the rectum, and from violent direct trauma as a kick or blow, falling on the buttocks or being run over.

Lacerations and *contusions* of the anus and rectum may result from too forcible dilatation or divulsion of the sphincter; the introduction into or removal of foreign bodies from the rectum; the impaction or expulsion of coproliths, of pointed or sharp foreign bodies such as fishbones, safety pins, false teeth and pieces of metal; and sitting down or falling upon rough, sharp objects.

In some instances foreign bodies have remained in the rectum several months or years without causing serious injury. Digital examination of the rectum and proctosigmoidoscopy are indicated when swallowed foreign bodies are unduly retained.

Sudden collapse of chairs, stools, chamber pots, fences, etc., may result in injury of the anus and rectum. Sharp fragments from these objects may lacerate the anus with severe hemorrhage, sever the sphincter or pass through the anal canal without injuring it and wound the rectum at a higher level.

Lacerated wounds of the rectum may complicate fracture of the pelvis. In several reported instances the anus and rectum, detached from the skin margin, retracted 1 or more inches. The lacerated sphincter remained *in situ* or was carried along. At the same time the urethra may also be torn or ruptured. The degree of trauma resulting in these severe complications generally proves fatal, but Griffiths and Kirstein reported recoveries, the fracture of the pelvis in each case being near the symphysis.

Chemical injury of the rectum has resulted from the injection of corrosive or other destructive agents into the rectum, as turpentine and bichlorid of

mercury. In Krause's case, a boy of four years, with retention of urine, had been placed in a sitz-bath of water so hot that the parts were scalded. After two years, the entire perineum was replaced by cicatricial tissue. The strictured anal canal was $\frac{1}{2}$ inch in length and only admitted a 25 F. urethral bougie.

Before the advent of the modern proctoscope, introduction of the whole hand into the rectum for examination, according to the method of Simon of Heidelberg, sometimes resulted in injury of the organ and serious consequences. Tuttle had no unfortunate complications, but reported fatal results in four cases in the hands of others.

Punctured wounds of the anus and rectum usually occur through stab or gunshot injuries, or falling upon sharp objects which pass through the perineum and penetrate the rectum or sigmoid at various levels, and may enter the abdomen. The most common site of perforation is the anterior rectal wall, from 3 to 5 inches above the anal sphincter. False passages of urethral sounds have frequently penetrated into the rectum. Accidental perforation of the bowel has occurred many times during perineal prostatectomy, perineorrhaphy and vaginal drainage of Douglas' pouch. During extirpation of pelvic tumors and hysterectomy, perforations of the sigmoid and rectum are not a rarity. The rectum has been perforated by the needle during sacral anesthesia as well as in local infiltration. Recently several cases of sloughing of the postcervical septum with perforation into the rectum, following medical diathermy of the cervix for gonorrheal endocervicitis, have been reported. Following fulguration of bladder tumors, sloughing has caused perforation into the rectum. Excessive doses of radium may also be followed by these unfortunate sequelæ. Occasionally punctured wounds are multiple, and this should be borne in mind in the diagnosis and treatment.

In the period when metallic bougies, dilators and syringe tips were in common use for diagnosis and treatment, injury and perforation of the rectum and sigmoid were encountered more frequently than at present. Injuries from syringe nozzles are generally below the reflection of the peritoneum. An ulcer may result from superficial wounds, while perforation of the wall is frequently followed by a rapidly spreading suppurative periproctitis or peritonitis. The situation is aggravated if the solution is injected into the tissues or peritoneal cavity before discovery of the accident.

Overdistention of the bowel by air, water or solutions during examination or treatment has occasionally caused laceration or perforation, especially when its walls are thin or friable from ulceration, syphilis or malignancy. Sudden and forceful dilatation of a rectal stricture with a metallic dilator may rupture the bowel at this point. Stiff bougies passed blindly have caused fatalities. Of twenty-five injuries caused by bougies, collected by Nordmann, three were perforations. Fortunately, since the soft-rubber Wales bougie has replaced the inflexible instruments, injuries of this sort are now of rare occurrence. Doubtless more cases of perforation of the upper rectum and sigmoid have occurred while making proctoscopic examinations than are reported. Tuttle knew of three from the

Kelly tube and the author knows of two others. This accident should never occur if the precautions mentioned in the chapter on Examination are observed.

Gunshot Wounds.—In the Civil War, of a total of 245,700 gunshot wounds, 103 involved the rectum, with a mortality of 44 or 42.7 per cent. Bladder wounds complicated thirty-four of these cases, of which fourteen died, a mortality of 41.7 per cent. Fractures of the pelvic bones were known to complicate forty-six of the 103 cases, and Otis thought it probable that the bones were fractured in all cases. According to Delorme, in the Franco-Prussian War there occurred thirty-one wounds of the rectum, with fifteen deaths, a mortality of 48.4 per cent. Stevenson states that in the Boer War the rectum and pelvic colon were wounded in 161 cases, with thirteen deaths. The mortality following wounds of the rectum was 30.7 per cent.

During the World War, injuries of the rectum constituted 2.4 per cent of lesions of the abdominal viscera, with a mortality of 45.19 per cent. Wallace, who had an extensive experience in the World War, states that of 965 cases operated upon, the colon was wounded in 252. It was the only portion of the alimentary canal injured in 151 cases, and in forty-one of these the pelvic colon alone was involved, the wound being single in twenty-three cases.

Multiple wounds of the small intestine, mesentery and bladder frequently complicate gunshot injuries of the pelvic colon. Of the forty-one cases of pelvic colon injury, eighteen reported by Wallace were complicated by wounds of the small bowel. In the twenty-three remaining cases, the wounds were sutured in sixteen and colostomy done in seven. Eight were evacuated, ten died and five could not be followed up. Bullet wounds of the pelvic colon may be so small as to be missed unless good exposure is obtained by extending the abdominal wound to the pubes, the Trendelenburg position used, and the pelvic cavity sponged dry.

Wounds from shell fragments are usually extensive lacerations of the buttocks which frequently involve the anal sphincters and rectum and may be associated with fractures of the pelvis.

Gunshot wounds are of a particularly serious nature owing to the great extent of tissue traversed and the commonly associated injuries. The high mortality attending wounds of the rectum and pelvic colon results primarily from the frequently associated injuries of other portions of the large or small bowel and the bladder, and the ensuing peritoneal sepsis. Fracture of the pelvic bones is an additional serious complication. The entering wound is usually situated in the buttock or upper thigh, rarely in the perineum, or the missile may traverse the pelvis, in which event it is apt to wound both the rectum and pelvic colon, and sometimes the small intestine and bladder. Wounds of entry in these regions suggest at once the possibility of injury of the rectum or adjacent viscera, particularly if accompanied by signs of peritoneal irritation. A discharge of feces from the external wound at once reveals involvement of the rectum. In this event the wound may be entirely extraperitoneal, and the prognosis far better than

when the peritoneum is injured. Such wounds are, however, frequently followed by a rapidly spreading infection of the perirectal tissues, particularly in the retro-rectal space, and regularly result in fistulæ. Suppurative processes in any of the rectal spaces, recognized by digital examination and associated with constitutional symptoms of sepsis, invariably indicate an extraperitoneal injury of the rectum. Careful proctoscopy may assist in locating the exact site and extent of the injury. Less commonly the rectum may be only contused, but subsequent necrosis and sloughing may result in perforation of the rectum or adjacent viscera. The prognosis should, therefore, be guarded.

Impalement.—This unusual injury of the rectum or anus is one of the most severe occurring in civil life. It is more commonly met with in farming districts where individuals sliding or jumping off hay mows become impaled on the handles of hay forks, hoes, brooms, pitchforks, etc. The trauma is usually severe, since the entire body weight strikes the impaling object. Males are obviously in the majority. Of eighty-three cases collected by Heath, seventy were males. In females the vagina may be impaled. Madelung in his detailed collection of 276 cases, of which fifty-five occurred in children and seven in persons over sixty years of age, describes five cases of impalement through the vagina. In twenty-nine of the 276 cases death followed in less than two days. In eighty-four peritonitis followed and proved fatal in fifty-two. Of forty-four cases in which laparotomy was performed, twenty-nine recovered. He advises keeping the patient in the sitting posture after the injury, to facilitate the gravitation of feces, urine and effusions into the pelvis.

As observed by Van Hook, the impaling object appears to be directed toward the perineum by the convergence of the buttocks, and penetrating the viscera of the pelvis, it may traverse the entire peritoneal cavity and even pierce the diaphragm. In a remarkable case reported by Sargent, the patient lived for twenty years following impalement on a pitchfork handle, and the necropsy revealed a diaphragmatic hernia of the stomach and colon. Occasionally the impaling object pierces the buttock and wounds the rectum secondarily or becomes impacted in the sacrum, sometimes injuring the sacral plexus of nerves. Although all of the intra-abdominal viscera have been described as injured, the bladder is most frequently involved with the rectum. Hawley reported a typical example in which a man of thirty-seven was impaled on the stake of a hay fork and succumbed forty-seven days later from peritonitis. The necropsy presented a rupture of the rectum and bladder. The small bowel, even in deeply penetrating injuries, usually escapes.

Peritoneal sepsis, which may occur early or quite late, is the most dreaded complication of these injuries, and should be carefully watched for. It is indirectly responsible for the high mortality, and failure of its early recognition usually means a fatal issue. The colon bacillus is the usual infecting organism, but the tetanus bacillus has also been found.

Rupture.—This comparatively rare accident to the rectum usually proves fatal. It may either be the result of trauma or occur spontaneously. The most

common traumatic causes are falls from great heights, crushing injuries, being run over, etc., in which the rectum is ruptured secondarily.

In fracture of the pelvis, the pubic segment of the pelvic girdle is most frequently involved. In consequence the bladder and urethra are often ruptured, but the rectum usually escapes injury, though it occasionally is lacerated. Thus, of 106 cases of fracture of the pelvis among coal miners, collected by Paul and Cloyd, the bladder was ruptured in five, the urethra in nine, and the rectum was injured in one case only. Spontaneous rupture of the rectum has resulted from sudden marked increase of intra-abdominal pressure, as violent vomiting, lifting heavy weights and severe straining at stool. In certain cases the etiology is obscure. However, in a majority of the reported cases, there was an antecedent history of recurrent prolapse, and it seems quite plausible that the gut wall had become attenuated and friable, and its vessels dilated, predisposing it to rupture by a mechanical force ordinarily of little significance. Too forceful reduction of a prolapse and efforts at removal of large irregular or impacted foreign bodies from the rectum have also caused rupture of this organ.

In cases of spontaneous rupture, the patient experiences acute abdominal pain, there is a discharge of blood, and sometimes from a few up to 18 feet of small intestine escape through the anus. The rectum, if prolapsed, may reduce spontaneously when rupture occurs. The tear is usually in the anterior rectal wall, and the herniated small bowel, becoming distended with gas and feces, is reduced with great difficulty through the comparatively small rent and against intra-abdominal pressure. The outcome was fatal in ten of eleven cases operated upon.

In addition to injury by impalement and bullet wounds, the sigmoid may be perforated by bougies, enema tubes or the sigmoidoscope, or wounded or ruptured by contusions, as a kick or fall, or other indirect violence. Of seventy-eight cases of contusion collected by Chenier, the cecum was involved in twenty-two, ascending colon in eleven, transverse colon in eighteen, descending colon in eleven, and the pelvic colon in sixteen. The solid nature of its fecal contents may be a factor in contusions of the sigmoid. The lesions occur chiefly at its fixed extremities and vary from subserous lacerations to complete rupture and injury of the mesentery. Hemorrhage into the peritoneal cavity is serious and frequently fatal, or the blood may infiltrate the mesosigmoid. In Chenier's series, only three of nine cases operated upon were successful.

Pneumatic Wounds.—With the more recent general use of compressed air in the trades, several instances of rupture of the rectum and colon have been reported. The accident may occur while workmen are using the air to blow the dust from their clothing, but usually the nozzle of the hose, delivering compressed air at a pressure of 60 to 85 pounds, was playfully placed over or near the anus, with extremely disastrous results. The air passes through the clothing, covering the anus, and always seems to be of sufficient pressure to penetrate the anal canal and rupture the bowel. No segment of the small or large intestine is exempt, but the sigmoid, acting as a trap, is the most common site of

injury. The lacerations are single or multiple and the rupture partial or complete. In partial rupture, the serosa and muscularis give way and the mucosa herniates through them. The opening may be small or several inches in length and be transverse, oblique or longitudinal.

Pneumatic rupture of the bowel is at once indicated by an outcry, collapse of the victim and great abdominal distention. Death followed in all of the thirteen cases reported by Andrews, three involving the rectum and ten the sigmoid. In another case seen by Andrews of partial rupture of the sigmoid for a length of 6 inches on its convex border, resection five hours after injury was successful.

Symptoms.—Wounds and injuries of the anus and rectum below the insertion of the levator ani muscle are usually recognized without difficulty. The history, the appearance of the wound, hemorrhage and pain, with a varying degree of shock, readily establish the diagnosis. On the other hand, deeper injuries involving the peritoneum or adjacent viscera may present extreme diagnostic difficulties. The amount of hemorrhage is quite variable; it may be mild or profuse, visible or concealed, and at times very deceptive, being entirely confined within the peritoneal cavity or colon. Secondary hemorrhage may likewise occur and add a serious complication.

The degree of pain is also a variable factor. It may be entirely absent or very severe, and is apt to be more intense in injuries involving the anal musculature and sacral plexus of nerves.

Shock depends in great measure on the extent of the hemorrhage, the degree of pain and the mechanism and violence of the injury. But even with involvement of the peritoneum it may be slight as evidenced by the case reported by Heath of a boy aged eighteen, who walked over a mile to the doctor's office after a penetrating wound of the rectum, although he died of peritonitis a few hours later.

Symptoms of peritoneal involvement may be entirely lacking for many hours following the injury, and this accounts in some measure for the high mortality. In twenty-six cases collected by Van Hook, in which there was perforation of the peritoneum, death followed in twenty, while in thirty cases of extraperitoneal injury all recovered. Tillmanns found that of 143 cases, thirty-eight died (26 per cent). Pain, rigidity, tympanites and shifting dulness may occur early and speak for peritoneal involvement, but unfortunately these symptoms frequently occur twelve or more hours after the injury, when a septic peritonitis is already well established. Vomiting, meteorism, hiccough, abdominal facies and collapse, with thready rapid pulse, form the terminal picture; usually within seventy-two hours. To wait for signs of peritoneal irritation is usually to have waited too long. From a record of the cases reported, it appears that the peritoneum is involved more frequently than is suspected, and it would seem advisable when at all in doubt to perform an immediate exploratory laparotomy, preferably under local anesthesia, and preceded by a blood transfusion, if the circumstances and condition of the patient permit.

Injury of the bladder may be indicated by suprapubic pain, painful micturition, by urine in the rectum or by blood and feces in the urine. When there is complete retention of urine, the catheterized specimen may contain blood and feces. Failure to obtain urine by catheter may indicate that it has escaped through the rectum or into the peritoneal cavity. In some instances of puncture or bullet wound of the rectum and bladder, there is no immediate leakage of urine or feces. Due to congestion and edema the tract of the missile may be temporarily closed, but in a few days reopens through subsidence of the edema or separation of a slough. The latter is especially apt to occur after a gunshot wound, the radiating trauma of which frequently causes gangrene along its course some days after the injury. Cystoscopy may prove helpful in detecting the bladder lesion. Absence of liver dulness, due to escape of gas into the abdomen, has been noted in cases of perforation. Escape of gas through the injured bowel has resulted in subperitoneal emphysema.

After external inspection, digital and instrumental examination of the terminal bowel is indicated to determine, if possible, the location and extent of the injury. A perforating wound of the bladder can usually be felt by the finger or seen through the proctoscope. The fact that there is no instant leakage of urine into the rectum does not exclude the possibility of a puncture of the rectovesical septum.

As a rule, perforations into the peritoneal cavity are beyond reach of the finger. Proctosigmoidoscopy, with the patient in the knee-chest or elevated lateral position, is always indicated. The apex of the sigmoid is the upper limit of its field. When using the tube, the examiner should depend on atmospheric pressure to distend the bowel, lest insufflation of air force septic material through a perforation into the peritoneal cavity. When no point of perforation can be detected by inspection, inability to distend the rectum and sigmoid by pneumatic pressure is conclusive evidence of perforation into the peritoneal cavity and demands immediate laparotomy. Incidentally it may be possible to partially control hemorrhage or fecal extravasation by packing through the proctoscope.

Treatment.—In the treatment of anal and rectal wounds it is of primary importance to determine, if possible, whether the lesion is extra- or intra-peritoneal, or both. Invasion of the peritoneum is at times quite obvious from the nature of the injury and the symptoms; on the other hand, it may be of the greatest difficulty. In extensive wounds of the rectum infection ensues rapidly unless prompt and adequate drainage is provided. Extraperitoneal wounds are best opened widely by careful débridement and the removal of foreign bodies, the dissection being carried sufficiently high to establish free drainage. Secondary suture may at times be possible after sterilization of the wound by antiseptic irrigations or by the Carrel-Dakin technic. Unless there are serious complications, the great majority of rectal wounds heal kindly with adequate care. In extensive lacerations involving large areas of the rectal wall and the sphincters, or with complicating fracture of the pelvis, colostomy is frequently the best procedure.

Temporary colostomy is indicated in persistent fecal fistula into the rectum or pelvic colon and in extensive rectal wounds in which it is impossible to otherwise control constant fecal contamination. Another argument for temporary colostomy in extensive wounds of the rectum is that stricture may follow and late colostomy become imperative, as Mummery observed in several soldiers invalided home during the World War.

If perforation of the bladder through a rectal wound occurs without involving the peritoneum, healing may be spontaneous. An indwelling catheter and rectal irrigations are indicated. A rectovesical or recto-urethral fistula persisting after due time requires operation for closure.

Wounds evidently intraperitoneal or those in which perforation of the peritoneum is strongly suspected, demand as a rule immediate exploratory laparotomy to determine the site and extent of the injuries. Although a few cases have been recorded in which the peritoneum was involved without subsequent peritonitis or sepsis, this favorable result is decidedly exceptional. A hypodermic of morphin should be given at once to arrest intestinal peristalsis until the operation can be performed. With the patient in the horizontal position the abdomen is opened through a median incision below the umbilicus and the pelvic cavity suctioned or sponged dry of blood and extravasated feces. Irrigations should generally be avoided as they may spread localized septic material throughout the peritoneal cavity. The Trendelenburg position may be essential for close examination of the sigmoid and bladder for injuries. When possible, wounds of the sigmoid and bladder are closed by a double row of sutures, and rubber dam or large cigarette-drains are inserted to the bottom of the pelvic peritoneal pouch, but should not impinge on the suture line. The omentum, tacked over the line of closure by a few sutures, is a most valuable protection. For extensive wounds of the sigmoid, resection with end-to-end anastomosis has been successful. A quicker and much safer procedure is to draw the injured portion of sigmoid through the abdominal incision and establish an artificial anus which can be closed later. This method is not feasible for intraperitoneal wounds of the rectum. If the deep pelvirectal wound cannot be securely sutured, colostomy is indicated. In the case of gunshot and other deep wounds of the rectum, the mesosigmoid is apt to be injured, with effusion of blood and infection. Therefore, in wounds of this character, involving the retroperitoneal space, the stoma should be made in the transverse colon, with opening and drainage of the infiltrated area.

After suture of the bladder, tension on the stitches is prevented by an indwelling catheter. Suprapubic drainage of the bladder should be avoided, if possible, when colostomy is done on account of the danger of infection. After operation the patient should be kept in the Fowler position to favor drainage to the pelvis and a tube inserted into the rectum to prevent gas pressure.

Because of the possibility of infection by the tetanus bacillus, particularly in gunshot wounds and injuries occurring in agricultural districts, a prophylactic dose of 1,500 units of tetanus antitoxin should be administered at once.

Gant estimates that in partial rupture of the colon without operation, the mortality is 95 per cent. The best results after rupture or perforation are obtained when the rent is repaired within four hours after the injury. If repair is delayed twelve hours or more, the mortality is at least 50 per cent.

Rupture of the rectum demands instant operation and suture of the wound, followed by drainage. If prolapse is present, laparotomy facilitates its reduction. If the prolapsed gut has been ruptured during attempts at reduction, circular amputation above the rent may be done without opening the abdomen. The results of laparotomy in six cases of perforation were four recoveries and two deaths; whereas of twenty-nine cases not operated upon, twenty-four died, a mortality of 82 per cent. In forty cases of gunshot injuries of the large bowel operated upon, Stevenson reported 67.1 per cent recoveries.

REFERENCES

- ANDREWS, C. W. *Surg., Gynec. & Obst.*, Jan., 1911.
 DELORME, E. *Traité de Chirurgie du Guerre*, Paris, 1888.
 GANT, S. G. *Diseases of the Anus, Rectum and Colon*, Philadelphia, W. B. Saunders Co., 1923, Vol. II, p. 470.
 HARASS, P. *Deutsch. med. Wchnschr.*, Oct. 28, 1909.
 HAWLEY, D. C. *The Proctologist*, March, 1909.
 HEATH, C. *Lancet*, Lond., 1887, 2: 1110.
 HENNINGSEN, E. J. *Am. M. Ass.*, Abstr., Sept. 22, 1917, p. 1040.
 HIRSCHMAN, L. J. *J. Am. M. Ass.*, Oct. 4, 1919.
 KROUSE, L. J. *Med. Rec.*, Oct. 29, 1892.
 MADELUNG, O. W. *Arch. f. klin. Chir.*, Berl., 1925, 137: 1-198.
 MEDICAL DEPARTMENT OF THE UNITED STATES ARMY. *History of World War*, 1921, Vol. XI, Part 1, p. 461.
 OTIS, G. A. *Medical and Surgical History of the War of the Rebellion*, Washington, 1876 and 1883, Vol. II, Parts II and III.
 PATEL, M. *Congrès français de chirurgie*, 1913.
 PENNINGTON, J. R. *Rectum, Anus and Pelvic Colon*, Philadelphia, P. Blakiston, 1923.
 SARGENT, J. *Boston M. & S. J.*, Feb. 22, 1875, p. 117.
 STEVENSON, W. F. *Wounds of War*, 2nd Ed., London, 1904.
 TILLMANN, H. *Deutsche Chirurgie*, 1905, Heft 62A.
 TUTTLE, J. P. *Diseases of Anus, Rectum and Pelvic Colon*, New York, D. Appleton & Co., 1907.
 VAN HOOK, W. *Month. J. Med. & Surg.*, June, 1896.
 WALLACE, C. *Proc. Roy. Soc. Med.*, Lond., Subsect. Proctology, May 10, 1916.
 ——— *Brit. J. Surg.*, Bristol, 1916, Vol. 4.

CHAPTER XXXV

FOREIGN BODIES IN THE RECTUM AND SIGMOID FLEXURE

The conformations of the rectum and sigmoid flexure peculiarly favor the arrest and retention of foreign bodies.

The anatomical predisposing factors are the coarctations at the anus and at the rectosigmoidal juncture, extraordinary development of the valves of Houston, and the crypts of Morgagni, and diverticula which occur most frequently in the sigmoid.

For purposes of description, foreign bodies may be classified as those:

- A. Formed within the bowel
- B. Reaching the bowel from other viscera
- C. Swallowed
- D. Introduced through the anus

A. Foreign Bodies Formed within the Bowel.—The normally functioning intestine naturally evacuates its contents regularly and so prevents accumulation of materials that enter into the formation of enteroliths and concretions. Hence, victims of habitual constipation, in whom exist defective innervation of the bowel wall or a congenital or acquired weakness of the intestinal musculature, are subject to fecal impaction and fecal tumors (fecaloma) and the same conditions predispose to the formation of enteroliths and concretions.

Intestinal calculi or stones, composed entirely of mineral (inorganic) substances, are a rare occurrence. As a rule the "intestinal stone" is made up of more or less organic material and a preponderating quantity of mineral constituents.

Leichtenstern distinguishes three groups of enteroliths:

1. *Calculi*.—Usually single and small (2 to 3 cm. in diameter); they may be enormous (23 cm. in circumference) weighing up to 4 pounds. The calculi are hard and heavy; in shape, ovoid or spherical; surface, dark brown, and on section show a uniform or concentric arrangement. Chemically they are composed mainly of phosphates of calcium, ammonium and magnesium, potassium sulphate and cholesterin, which is frequently deposited around a foreign body as a nucleus, *e.g.*, a fruit stone, pieces of bone, hair, scybalum, etc.

2. *Enteroliths* of low specific gravity consisting of a fungoid mass of indigestible vegetable matter, impregnated with mineral matter, principally phosphates. Avenoliths (oat stones) have been observed frequently in Scotland as a result of eating large amounts of coarse oatmeal.

3. *Chemic stones*, resulting from the prolonged ingestion of mineral drugs

for therapeutic purposes, as bismuth, salol, calcium and magnesium carbonate and bicarbonate of soda. This variety is rare and the stones are usually small but in a few instances have caused intestinal obstruction. Bismuth taken continuously for long periods has accumulated in the sigmoid and rectum as putty-like or hard concretions.

In forty-six cases tabulated by Gant, thirty-three were females and thirteen males. The age incidence was: Under ten years, two; ten to twenty-nine years, seven; thirty to forty-nine years, fourteen; fifty to sixty-nine years, fifteen; over seventy years, eight.

The situation of the enterolith in this group was: Rectum, thirty-five; sigmoid, six; descending colon, one; transverse colon, one; cecum, three. A single stone was present in thirty-six cases, in the others from two to thirty-eight, the latter in the rectum of Behring's patient, a woman aged sixty-one years.

B. Foreign Bodies Reaching the Bowel from Other Viscera.—Gall-stones are chief among these. Small gall-stones escaping from the common duct into the intestine are usually expelled without event. Almost invariably large gall-stones gain entrance to the bowel through a fistulous communication between the gall-bladder and duodenum, less frequently between the common duct and duodenum, and rarely between the gall-bladder and colon. In general, gall-stones give rise to symptoms or cause obstruction in the small intestine. Once they have passed the ileocecal valve their usual site of arrest is the ampulla of the rectum.

Bezoars or concretions of hair in sausage-shaped masses or balls are frequently found in the intestines of animals that lick themselves—cats, cows and horses—and may cause intestinal obstruction. In the human, bezoars usually form in the stomach of women given to the habit of chewing and swallowing their hair. In a demented woman treated by Gant, a hair ball with the accumulated feces formed a hard mass (orange size) in the rectum which caused complete obstruction.

Urinary calculi have been known to escape into the rectum through a rectovesical fistula.

Cripps, Chatterjee and Wolf have each reported a case in which the products of ectopic gestation have ruptured into the rectum from Douglas' pouch. The fetus may become mummified or calcified and years later passed by rectum. Adler's patient, a woman, aged forty-two, had ectopic pregnancy six years before consulting him. Two years after the ectopic she developed intermittent attacks of diarrhea and finally rectal pain and tenesmus and passed from the rectum "a bunch of bones." Digital examination revealed a mass about 4 inches up, on the anterior rectal wall, which felt much like the hinged halves of a clam-shell when half open, the edges being sharp and exposed. The mass was removed successfully and consisted mainly of the bones of a fetal skull.

Several instances are on record where a pessary applied to support the uterus has ruptured through the rectovaginal septum.

Foreign bodies inadvertently left within the abdomen during surgical oper-

ations give rise to serious disturbances and frequently reach the bowel lumen through puncture, pressure necrosis, ulceration, or abscess and perforation. Surgical instruments, drainage tubes, gauze and cotton are the objects found most frequently in these cases.

C. Foreign Bodies Swallowed.—If a swallowed foreign body passes the esophagus, pylorus and ileocecal valve it is usually expelled without causing symptoms. The chief points of lodgment in the large bowel are cecum, sigmoid and rectum. In the majority of instances it is arrested or blocked in the lower inch of the rectum. Foreign bodies are swallowed intentionally or accidentally.



FIG. 413.—UNKNOWN TYPES OF FOREIGN BODIES CAUSING INTESTINAL OBSTRUCTION.
(Carp, *Ann. Surg.*, Philadelphia. Courtesy of J. B. Lippincott & Co.)

Articles of every conceivable form, size and composition have been swallowed. The types of objects are usually small and sharp or pointed; smooth and dull, or of irregular shape.

Smugglers, thieves and other criminals swallow articles for purposes of concealment, and insane persons with the object of self-destruction. Formerly laborers in the South African mines concealed diamonds in this way. Schumacker's patient, an insane man, during eight months passed 157 pieces of glass, 252 pins, three large hairpins, fragments of iron and lead and half of a shoe-buckle. Vanderkolk's patient, also an insane man, passed a door key 5.4 inches long and a nail 5.8 inches in length.

Knives, forks and other long irregular objects have been passed without

hindrance but are frequently arrested in their course. Persons who gain a livelihood by swallowing foreign substances, "sword-swallowers," usually develop fatal complications—gastric and intestinal perforation and peritonitis. Brodie relates such a case in which a swallowed knife blade lodged transversely in the rectum and perforated its wall, with fatal consequences.

From the clinical standpoint, greater interest attaches to foreign bodies swallowed *accidentally*. The small bones of fish, chicken or birds are frequently ingested unconsciously while eating. Children at play accidentally swallow coins, buttons, beads, pebbles and small toys. Adults, while working, frequently swallow pins, needles, screws or tacks held in the mouth. Some children and women have a habit of swallowing a single type of foreign body. Artificial dentures, swallowed accidentally, in a number of instances have been recovered from the rectum. Tuttle saw two cases in which plates of false teeth were swallowed and lodged, one in the sigmoid and one in the rectum. Earle reported the case of a woman who, while eating, swallowed a plate with two false teeth. Ten days later and at irregular intervals thereafter, she experienced violent abdominal pains. After a lapse of several months, the x-ray located the plate in the sigmoid flexure at the level of the sacral promontory. Through the sigmoidoscope the plate was seen and grasped with alligator forceps and withdrawn in the wake of the instrument.

The pits of cherries, plums, grapes, watermelons and other fruit, eaten gluttonously, frequently accumulate in and clog the rectum, as may the shells of nuts and chips of wood. For example, Tuttle removed from the rectum of a woman a mass of grapeseeds almost as large as a fetal head, that weighed 22 ounces. Oldag removed a mass containing 480 cherry pits from the rectum of a man, aged sixty-eight. In the case of Wescott, a boy of eight years, the mass



FIG. 414.—RADIOGRAM OF PIN IN INTESTINE OF ELEVEN-YEAR-OLD GIRL, THE HEAD OF WHICH PERFORATED THE SIGMOID SIX DAYS AFTER IT WAS ACCIDENTALLY SWALLOWED.

Peritonitis ensued. Recovery followed operation. (Carp, *Ann. Surg.*, Philadelphia. Courtesy of J. B. Lippincott & Co.)

of cherry pits weighed 7 ounces. Poulet relates a case in which sixty snails were found in the rectum. Articles used for therapeutic purposes have escaped into the stomach, *e.g.*, a stomach tube, a tube with radium.

The length of time it takes a foreign body to pass through the intestinal tract is most variable. The interval may be unusually short, as in Cripps' patient where a plate of teeth swallowed was recovered the following morning. Generally the time is much longer, for the foreign body in its transit may have been lodged in some fold or diverticulum of the intestine, dislodged and again arrested. Tuttle removed a tin tag from the rectum of a child who had swallowed it eighty-four days previously. The tag was imbedded squarely across the anus,

forming a complete metallic occlusion. Several cases are recorded in which the foreign body was removed from the rectum several months up to four or more years after it was swallowed.

Carp has recently reported forty-eight cases of foreign bodies in the intestine occurring at the Presbyterian Hospital, New York, from 1915 to 1926. All were swallowed.

Twenty-six of the patients were males, twenty-three females. The youngest patient was aged five months, the oldest sixty-four years, and 80 per cent of the patients were under ten years of age. The objects swallowed were sharp in twenty-three cases, dull in twenty-five. All were small except two, a stomach tube and a partial denture.

Thirty-one cases were followed up and analyzed. In twenty-five of these, or 80 per cent (ten of twelve sharp, and fifteen of nineteen dull), the object was passed without complications.

The time of passage was: For sharp objects, shortest two days, longest three weeks, average 7.33 days; for dull objects, shortest twenty hours, longest four weeks, average five days. Abdominal pain and vomiting were present in only four of twenty-five cases in which the foreign body was passed.

Complications.—One patient with acute and another with chronic ileus died. A pin, swallowed six days previously by a child aged eleven years, perforated the sigmoid and peritonitis ensued. Recovery followed operation (Fig. 414). Acute appendicitis (one case), recovered. Pelvic peritoneal abscess (one case), recovered.

When a foreign body is pointed at one end, it tends to pass through the intestinal canal and to be evacuated head forward due to the point catching in

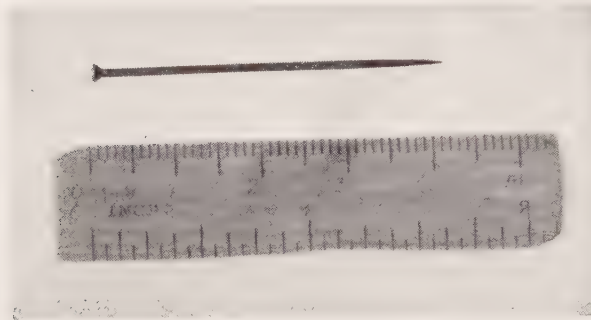


FIG. 415.—PIN SHOWN IN FIG. 414 RECOVERED AT OPERATION.

(Carp, *Ann. Surg.*, Philadelphia. Courtesy of J. B. Lippincott & Co.)

the mucosa while the fecal current carries forward the blunt end. Exner, by carefully controlled experiments on animals, demonstrated that the intestinal wall reacts to a foreign body by producing, at the point of mucosal contact, concavities with muscular margins. The resultant increase in diameter of the bowel lumen aids peristalsis and movement of intestinal contents in carrying forward the foreign body. This accounts for the rather infrequent occurrence of perforation (two of twelve cases). The wide caliber of the large bowel permits foreign bodies to turn around, lodge and perforate more frequently than in the small intestine.

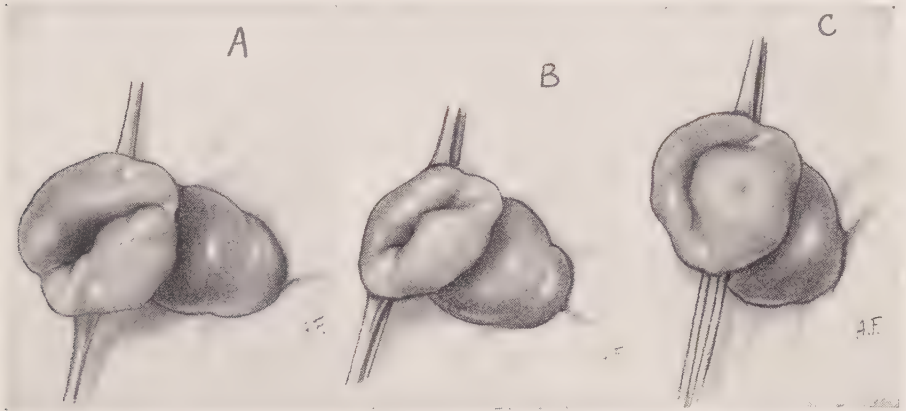


FIG. 416.—REACTION OF INTESTINAL MUCOSA TO FOREIGN BODY STIMULUS.

A, showing two small concavities on the mucosa of small intestine of dog produced by gentle pricks of needle point. They were preceded by a temporary area of anemia and appeared in about two minutes, gradually becoming deeper and slowly disappearing in about two minutes.

B, similar trough-like reaction produced by gentle stroke of needle point. It disappeared in about fifteen minutes.

C, concavity with surrounding area of marked anemia produced by pushing into mucosa gently with blunt end of artery clamp. The anemia persisted for about twenty minutes, and the concavity fifteen minutes. (Carp, *Ann. Surg.*, Philadelphia. Courtesy of J. B. Lippincott & Co.)

If a foreign body is retained a sufficient time in the intestine, the digestive juices may affect it. Bone may be decalcified, glass rounded off and metal broken. The feces and food envelop some foreign bodies and so limit their power to injure.

D. Foreign Bodies Introduced into the Rectum.—A remarkable list of foreign bodies of various sizes and shapes have been introduced through the anus into the rectum by accident or design.

Accidental.—Several cases are reported in which as a result of falling upon a stick, pitchfork, cow's horn, etc., the object passed through the anus or penetrated the buttock and was broken off and remained in the rectum.

During examination or treatment metal and wooden applicators, probes, hypodermic needles, copper and silver sticks have escaped into the rectum. Syringe nozzles, irrigating tips and thermometers have been broken off and

left in the rectum, and anal dilators and bougies have been recovered from the rectum.

For the Relief of Symptoms.—Various foreign bodies have been found in the rectum, introduced usually by ignorant persons, for the relief of symptoms or cure of a pathological condition, to wit: To relieve itching, to reduce pro-

lapse, to “cure” hemorrhoids, to relieve constipation, to stop diarrhea, to close the bowel and so require less food. Bodies used for these purposes may escape from the grasp of the patient into the rectum.

It is a clinical fact that in some cases of pruritus ani temporary relief follows the introduction of a bougie or the finger.

Ferguson removed from the rectum of a man a bougie 1 inch in diameter and 10 inches long which he was accustomed to introduce for the relief of constipation.

Adler reported the case of a machinist, aged sixty, who wore in the anus “the handle and valve of a steam radiator pipe” as a pile supporter. This accidentally slipped within the bowel and Adler found it firmly wedged between the ischium and promontory of the sacrum. Under general anesthesia the object was extracted with difficulty and

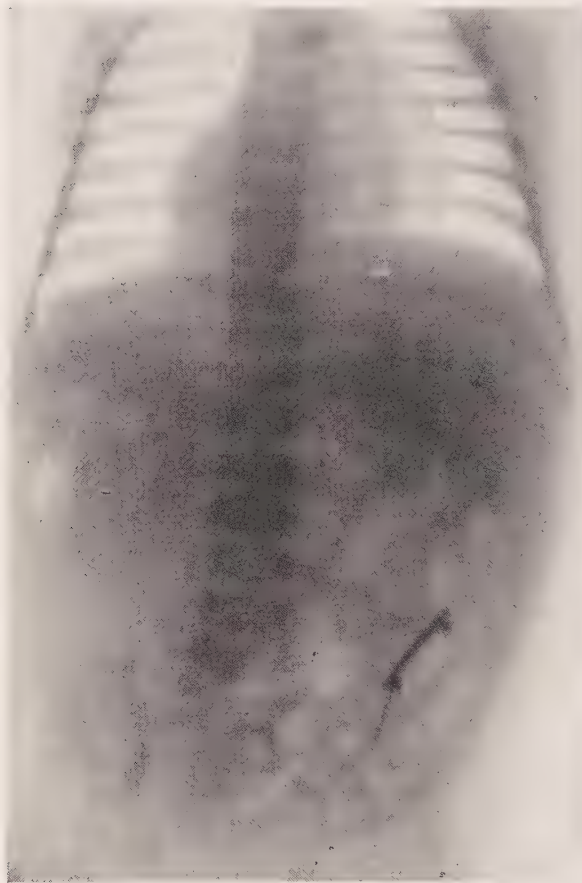


FIG. 417.—RADIOGRAM OF OPEN BAR PIN IN INTESTINE OF FIVE-MONTHS-OLD BABY, PASSED IN THREE DAYS. (Carp, *Ann. Surg.*, Philadelphia. Courtesy of J. B. Lippincott & Co.)

the patient left the hospital on the third day. The body measured $2\frac{1}{2}$ by $2\frac{1}{2}$ by 1.5 inches.

For Purposes of Concealment.—Insane persons have concealed various objects in the rectum. Thieves and criminals have utilized the rectum to conceal stolen articles or instruments for crime. Gems, jewels, coins, false keys, etc., have been discovered in the rectum during life or after death. A miner in Chile

concealed in the rectum a block of silver ore, $5\frac{1}{2}$ inches in length and $8\frac{1}{2}$ inches in circumference, and weighing over 8 pounds.

Clasmadeuc narrates the case of a criminal from whose transverse colon there was removed a cylindric-shaped box, 6 inches long and 5 inches broad, weighing 22 ounces, and containing coins, saws and numerous other instruments. The box, concealed in the rectum, worked its way up into the transverse colon where it caused peritonitis and subsequent death.

By Sexual Perverts.—"It is known that the sexual orgasm may be excited by stimulating the reflex power of the rectum, and it is probable that at the moment when the orgasm is at its height the body used to produce it is allowed to escape from the hand and is lost within the bowel" (Kelsey). This disgusting habit is practiced by some old men whose desires have survived their virile powers. Seldom will they acknowledge the cause of the accident, nor because of shame consult a physician until their suffering has become unbearable.

Long, smooth, round objects are generally used for the purpose. Perhaps the majority of bottles, bougies, canes, candles and sticks found in the rectum have occurred in this way.

Warren's patient, a man aged forty, used a catsup bottle measuring 10 inches in length and 9 inches in circumference at the base. It slipped into the bowel neck end first. Its base was felt readily in the rectum, while its upper extremity was palpable in the epigastrium, to the right of the median line. Following several futile efforts, linear proctotomy was performed and the bottle was extracted with the fingers and forceps, aided by abdominal pressure.

Several instances have been reported in which long foreign bodies introduced per anum perforated into the bladder, leaving rectovesical fistula; others in which the peritoneum was perforated causing death; and numerous cases in which rectitis, ulceration, periproctitis, abscess and fistula resulted.

Symptoms.—The symptoms are subjective and objective. A swallowed foreign body in its passage may produce few or no symptoms, other than mild cramps. When temporarily arrested at several points in its passage it gives rise to localized cramps and pain and the irritation may cause diarrhea, with mucus and blood in the stools. As a result of permanent lodgment, intestinal obstruction, pressure necrosis or perforation may occur, with the local inflammatory and constitutional symptoms characteristic of these conditions.

When a foreign body has reached the rectum, the symptoms will depend largely on its size and shape. Small, smooth bodies like coins or a marble are generally evacuated without symptoms.

Large round or smooth foreign bodies in the rectum produce a feeling of fullness and a dull, aching pain, increased by exertion, straining at stool, or coughing. Pressure upon the abdomen, or upon the perineum while sitting, may aggravate the discomfort.

An irregular body, with sharp edges or points, will cause pain on motion and efforts at defecation. If a pin, fishbone or other sharp body lodges in the anal canal or is caught in an anal crypt, spasm of the sphincters and severe sphincter-

algia ensue. Spasm of the levator ani and sphincter with constipation is frequently excited by a foreign body in the rectum and increased by movement or exertion. If a pointed object has penetrated the tissues the spasm may be continuous.

As a rule, the longer a foreign body remains in the rectum, the more severe the pain and other symptoms. A large foreign body may completely block the rectum with symptoms of obstruction, or excite tenesmus and a spurious diarrhea, with discharge of blood-tinged mucus. The functions of adjacent organs may be disturbed due to pressure of the foreign body. Symptoms of cystitis have been noted in some cases and in Wescott's case a large impacted mass of cherry pits compressed the urethra against the pubic arch, causing enormous distention of the bladder. Reflex phenomena are manifested in pain in the scrotum, testicles, or shooting down the thighs.

Objective symptoms may be absent, or those of a simple inflammatory condition of the rectum. When the foreign body is very large, a bulging of the perineum may be felt and seen and the anus may be protruded. Surprisingly large objects have been introduced without evident traumatism of the anal canal, especially by sexual perverts. On the other hand, a wound, crack or fissure of the parts may indicate the accidental introduction of a foreign body, although there is no bleeding at the time of examination.

Complications.—The complications and accidents associated with foreign bodies are very numerous, depending largely upon the character of the body, the method of its introduction, and amount of manipulation and traumatism in efforts to expel or remove it.

Small foreign bodies are usually evacuated spontaneously, but a sharp object like a pin may injure or perforate the sigmoid or rectum, and wound the anal canal, resulting in a fissure, ulcer or inflammatory condition about the margin of the anus.

Peritonitis or a peritoneal abscess follows perforation of the bowel above the peritoneal reflection from the rectum. Physiologically, violent peristalsis or straining may force the object through the gut wall; and pathologically, a constriction by carcinoma, tuberculosis or diverticulitis predisposes to arrest and perforation by a foreign body.

Although a foreign body may rest in the rectal lumen without serious inconvenience, as a rule, the longer they remain the more likely are they to produce serious complications. When large they cause inflammation, thickening of the walls of the gut, ulceration, sloughing and sometimes stricture. If the body has a large open end like a jar or drinking glass, the swollen, edematous mucosa may invaginate into it and hamper extraction. Irregular objects, sharp, angular or pointed, may perforate the walls of the gut and produce a periproctitis, abscess and fistula. In a number of instances the author has removed a bone or other small sharp object from an abscess about the rectum, and it is very probable that many abscesses and fistulæ originate through perforation by a foreign body.

When a foreign body remains for a considerable time in the rectum it may become the nucleus of a concretion, due to the deposit of fecal matter around it. Rarely the body is encrusted with calcareous salts.

Exceptionally a long, thin foreign body, like a fishbone or needle, perforates the bowel and enters the peritoneal cavity, whence it may emigrate to distant points; or it may migrate to another viscus, notably the bladder, where it causes cystitis and may be voided spontaneously or require extraction. David's patient, an adult, after cystitis for twenty-nine months passed a fishbone per urethram.

Foreign bodies introduced into the rectum sometimes travel upward into the colon. Whether this is due to reversed peristalsis, excited by irritation of the object, or other causes, is not clear. Of thirty-four cases collected by Gérard, the objects remained in the rectum in seventeen, migrated into the sigmoid flexure in twelve, and ascended to a higher level in five.

Diagnosis.—With the history of ingestion of a foreign body or its introduction through the anus, the diagnosis is usually easy; without such a history, diagnosis may be difficult, if not impossible.

The reliable means of diagnosis are palpation, the proctoscope and the x-rays. The finger will detect the majority of foreign bodies in the anus and rectum. When, as often occurs, it has slipped up beyond the reach of the finger, or has lodged in the sigmoid flexure, recourse must be had to the proctoscope.

With the pneumo-electric proctoscope one can closely inspect the interior of the bowel to the apex of the sigmoid, diagnose the presence and nature of the object, and in many cases grasp and remove it with forceps with the least amount of traumatism. In case both of these methods fail, an x-ray examination is in order. By it, the size, shape, nature and location of foreign bodies that cast a shadow or are opaque to the rays can be ascertained. Notable among these are metallic substances, undecalcified bones, concretions containing lime salts, porcelain and glass containing salts of lead. Fruit pits appear as vacuulations on the roentgenograms. Large or long foreign bodies may frequently be detected by abdominal palpation.

Prognosis.—In general the progress is favorable. Ingested foreign bodies are usually small and if they negotiate the alimentary canal without complications, they usually lodge just above the anal canal and may be extracted safely. In 20 cases reported by D. H. Goodsall, the body was located within the lower inch of the rectum. Perforation occurs in 10 per cent, or less, of the cases.

When the object has been introduced through the anus into the rectum, the prognosis in general is good. However, it is modified by the size and shape of the body, its fragility, its location, whether above or below the peritoneal pouch, the injuries inflicted at the time of introduction, and the damage done by manipulation in the efforts to extract it. The gravity to the prognosis is frequently in proportion to the period of time elapsed since the introduction of the foreign body. If no complications have occurred at the time the foreign body was intro-

duced and it is removed promptly without injury to the parts, the prognosis is good.

Treatment.—When there is a history that a bone, pin, tack or other object has been swallowed, oatmeal, vegetables or other pultaceous foods leaving a large residue should be ingested to envelop the article and protect the mucosa of the alimentary tract from injury. Agar-agar and mineral oil may also be administered to facilitate its passage.

When the diagnosis of a foreign body in the rectum or sigmoid is made, its removal at the earliest moment possible is indicated. As a rule, purgatives are contra-indicated. They may intensify the pain and the exaggerated peristalsis they excite may force a sharp pointed body into the tissues and invite trauma, laceration and perforation.

Before extraction is attempted, the bowel should be irrigated freely with an antiseptic solution.

Small objects in the rectum can usually be removed with the fingers, aided, if necessary, by a suitable forceps. Soft metal objects, such as safety pins, hair-pins, or wire may be cut in two by forceps and the pieces withdrawn. A body of small or medium size, discovered on proctoscopic examination in the rectum or pelvic colon, can be grasped by an alligator forceps and removed through or in the wake of the tube as it is withdrawn.

When the body is glass, china or other fragile material, great care to avoid breaking them should be exercised, lest the fragments lacerate or perforate the rectal wall, or cut vessels and cause severe hemorrhage. Should fracture be necessary, effort should be made to pack gauze between the object and the rectal wall to guard the latter from injury.

Large foreign bodies introduced through the anus into the rectum frequently present unusual difficulties in their extraction. They have sorely taxed surgical ingenuity and each case seems to be a law unto itself.

In general the objects are of two classes, fragile and non-fragile. Only general principles for their removal can be stated. Bottles of various sizes, jars, tumblers and drinking glasses are examples of large fragile bodies which have been encountered most frequently. In the case of glasses and jars with wide mouths, if the opening is upward, straining and tenesmus cause the bowel to prolapse into it. The ensuing congestion and swelling may obstruct the intestine absolutely and when traction is made the object tends to drag the bowel down with it. Perforation of the closed lower end of the object to gain the benefit of atmospheric pressure, or fracture of the fragile body seem to be the only means of releasing the bowel. When the mouth of the hollow object points downward, the swollen, edematous mucosa distal to it hampers extraction.

Large, solid, smooth or rough non-fragile objects, which cannot be removed by the fingers, have been extracted by applying small obstetric, placental or other forceps, the blades of which should be covered with rubber tubing or chamois to prevent injury to the tissues. Rough serrated foreign bodies are covered with gauze or cotton to prevent injury of the mucosa during extraction.

Too vigorous or unwise manipulation of a foreign body in the rectum may push it up in the sigmoid flexure beyond reach of the fingers or grasp of an instrument, or force it through the bowel wall into the peritoneal cavity. Should perforation occur prompt laparotomy has been successful in a few cases but fatal peritonitis has resulted in others.

As a rule, the patient should be anesthetized and the sphincters thoroughly dilated. After irrigation to remove infective substances, oil or vaselin injected may facilitate removal.

The blade of a speculum introduced through the dilated anus and passed between the object and the posterior wall of the rectum has made extraction possible in some cases.

If congestion, edema and swelling so narrow the anal canal that the body cannot be removed, split the rectum backward to the coccyx.

In the case of a long foreign body as a bottle, stick of wood, or metallic rod, the upper end of which is above the sacral promontory and often palpable through the abdomen, and the lower extremity impacted in the hollow of the sacrum, the coccyx is the anatomical bar to extraction.

Delbet demonstrated on the cadaver that a body of greater length than the distance from the coccyx to the sacral promontory is pressed backward by the prostate and triangular ligament and held at these three points. If now the object is pushed up above the coccyx it changes its direction, the base becoming impacted in the hollow of the sacrum, while its upper extremity impinges on the pelvic colon and may be felt in some cases to the left of the navel. Delay in removal results in pressure necrosis, infection and perforation. In order to effect extraction in these cases, it is necessary to mobilize the coccyx so that it can be displaced backward, or to excise it. Retraction of the wound margins will usually permit extraction through the enlarged exit of a large foreign body impacted in the cavity of the sacrum. Combined rectal and abdominal manipulation is in general to be avoided as it increases the hazard of injury or perforation of the sigmoid flexure. The incised wounds are sutured.

After the removal of a foreign body from the rectum, the cavity should be irrigated with warm 2 per cent boric acid solution or potassium permanganate 1:10,000. Small lacerations and punctures of the rectal mucosa or wall are treated by irrigations, but large wounds are closed by suture and drainage. Oozing of blood is controlled by hot irrigations and packing, when necessary.

Rest and a constipating diet for five or six days physiologically control bowel movements.

Foreign Bodies in the Sigmoid Flexure.—When a large foreign body has lodged or escaped into the sigmoid flexure, operation, as a rule, is the only rational procedure. The abdomen is opened through a left rectus incision, the gut containing the foreign body is drawn out through the wound if possible, incised longitudinally and the body removed. Otherwise the rest of the abdominal cavity is protected by gauze pads and the bowel opened *in situ*. Mummery suggests that, when possible, the object, *e.g.*, a calculus, should be moved into

a healthy portion of colon and that after its removal the interior of the bowel should be examined for a stricture which is frequently present. The wound is sutured and the gut returned into the abdomen. In case the bowel is seriously damaged it may be resected and end-to-end anastomosis made, but if it is gangrenous, all of the involved area should be brought outside the abdominal wound, sutured to its edges, and an artificial anus established.

REFERENCES

- ADLER, L. H., Jr. *Am. Med.*, July 20, 1901.
 ——— *Tr. Am. Proctol. Soc.*, 1908.
 CARP, Ralph. *Ann. Surg.*, Phila., April, 1927.
 CHATTERJEE, T. C. *Indian M. Gaz.*, Calcutta, August, 1918.
 CLASMADEUC. *Soc. de Chir.*, May 15, 1861.
 CRIPPS, Harrison. *Ovariectomy and Abdominal Surgery*, London, 1898.
 DAVID, I. *Brit. M. J.*, Lond., Feb. 2, 1918.
 DELBET, Pierre. *Traité de Chirurgie*, Le Dentra-Delbet, Paris, 1899, 8: 404-405.
 EARLE, S. T. *Tr. Am. Proctol. Soc.*, 1908.
 EXNER, Alfred. *Arch. f. d. ges. Physiol.*, 1902, Vol. 89.
 FERGUSON. *Practical Surgery*, p. 750.
 GANT, S. G. *Rectum, Anus and Colon*, Philadelphia, W. B. Saunders Co., 1923, Vol. II.
 GÉRARD, C. *Thèse de Paris*, 1878.
 GOODSALL, D. H. *St. Barth. Hosp. Rep.*, Lond., 1887, Vol. 23.
 KELSEY, C. B. *Surgery of the Rectum*, 6th Ed., New York, Wm. Wood & Co., 1902, p. 344.
 LEICHTENSTERN, Otto. *Cyclopedia of Practical Medicine*, New York, Von Ziemssen, 1876, Vol. VII, p. 477.
 MUMMERY, P. Lockhart. *Diseases of the Rectum and Colon*, New York, Wm. Wood & Co., 1923.
 OLDAG, H. *Deutsche med. Wchnschr.*, Berl., Sept. 5, 1912.
 POULET, A. *A Treatise on Foreign Bodies in Surgical Practice*, New York, 1881.
 SCHUMACKER. Cited by Esmarch in *Deutsche Chirurgie*, Stüttgart, Billroth-Lücke, 1887.
 SIMMONS, G. S., and VAN GLAHN, W. C. *J. Am. M. Ass.*, Dec. 28, 1918.
 TUTTLE, J. P. *Anus, Rectum and Pelvic Colon*, New York, D. Appleton & Co., 1906.
 WARREN, J. C. *Boston M. & S. J.*, 1890, Vol. 122.
 WESCOTT, W. H. *Boston M. & S. J.*, Feb. 24, 1876.

INDEX

- Abdomen, operations through, complete rectal prolapse repaired by, 405
- Abdominal colostomy, mortality of, 600
- types of, 599
- *See also* Colostomy.
- Abdominoperineal proctectomy, combined operation of, 563
- — Coffey's method of, 570
- — eversion method of, 570
- — mortality of, 585
- — preservation of bowel continuity in, 568
- Ablation, partial prolapse of rectum and, 380
- *See also* Excision; Proctectomy.
- Abscesses, chronic ulcerative colitis and, 280, 292
- cutaneous, 211
- fistula caused by, 221
- fistula complicated by, treatment of, 239
- hepatic, amebic dysentery complicated by, 307
- infralevator, cutaneous, 211
- — ischiorectal, 211
- — marginal, 211
- ischiorectal, diagnosis of, 214
- — etiology of, 213
- — horseshoe fistula and, 14
- — symptoms of, 214
- — treatment of, 215
- marginal, 211
- — treatment of, 212
- mural, treatment of, 220
- pelvirectal, classification of, 210
- — etiology of, 208
- — pathology of, 209
- — treatment of, 210
- perianal, classification of, 210
- — etiology of, 208
- — pathology of, 209
- — treatment of, 210
- perirectal, classification of, 210
- — etiology of, 208
- — pathology of, 209
- — treatment of, 210
- prerectal, 6
- retrorectal, diagnosis of, 219
- — etiology of, 218
- — treatment of, 219
- stercoral ulceration causing, 323
- submucous, treatment of, 220
- superior pelvirectal, symptoms of, 216
- — treatment of, 217
- supralevator, mural or submucous, 220
- — retrorectal, 218
- — superior pelvirectal, 216
- tropical liver, 307
- Acidophilus milk, chronic constipation and, 130, 134
- pruritus ani and, 180
- Actinomycosis, diagnosis of, 342
- incidence of, 340
- pathology of, 341
- prognosis of, 343
- symptoms of, 342
- treatment of, 343
- Acute amebic dysentery, 302, 306. *See also* Dysentery, amebic.
- Acute bacillary dysentery, 301
- Acute catarrhal proctitis, 260
- Acute intestinal obstruction, 441, 444
- Acute volvulus, 438, 440
- Adenocarcinomata, pathology of, 500
- Adenomata, carcinomata differentiated from, 514
- multiple rectal and sigmoid, diagnosis of, 463
- — etiology of, 459
- — malignant transformation of, 462
- — symptoms of, 461
- — treatment of, 463
- rectal and sigmoid, diagnosis of, 449, 463
- — incidence of, 446
- — symptoms of, 449, 461
- — treatment of, 450, 463
- Adenomyomata, rectal, diagnosis of, 471
- — occurrence of, 469
- — symptoms of, 471
- Adhesions, chronic mucous colitis and, 273
- stasis toxemia and, 124
- stercoral ulceration causing, 323
- Agar-agar, chronic constipation and, 132
- Alcock's canal, relation of anal canal to, 13
- Alcohol, injection of, coccygodynia and, 191
- Amebæ, coloproctitis caused by, 300
- Amebiasis, occurrence of, 302
- Amebic dysentery, 302, 306. *See also* Dysentery, amebic.
- Amputation, complete prolapse of rectum reduced by, 408
- rectal, perineal operation for, 547
- — *See also* Excision; Proctectomy.
- Anal canal, anatomy of, 12
- arteries of, 17
- conformation of, 12
- congenital narrow, 48
- congenital stenosis of, treatment of, 55
- development of, 33, 38
- ischiorectal fossæ and, 13
- lymphatics of, 21
- nerve supply of, 23
- physiology of, 12
- relations of, 12

- Anal canal, stricture of, ulceration causing, 321
 — vascular supply of, 17
 — veins of, 18
 — *See also* Anus.
 Anal fissure. *See* Anus, fissure of.
 Anal fistula, 221. *See also* Fistulæ, anal.
 Anal outlet, plastic narrowing of, complete rectal prolapse and, 391
 Anal warts, diagnosis of, 476
 — pathogenesis of, 475
 — symptoms of, 476
 — treatment of, 476
 Anastomoses, rectosigmoidal, importance of, 29
 Anemia, chronic mucous colitis and, 270
 — chronic ulcerative colitis and, 285
 Anesthesia, carcinoma of rectum and, 545
 — caudal, 103
 — general, 102
 — examination under, 95
 — internal hemorrhoids and, 158
 — local, 103
 — regional, 103
 — sacral, 103
 — technic of, 104
 — tuberculous fistula operated under, 245
 — spinal, contra-indications for, 116
 — indications for, 115
 — materials for, 113
 — mortality from, 116
 — postoperative care in, 115
 — rectal carcinoma and, 545
 — technic of, 114
 Anesthesia, rectal ulceration and, 321
 Angiomata, rectal, treatment of, 473
 Angulation, megacolon caused by, 426
 Aniline dyes, chronic ulcerative colitis and, 290
 Anococcygeal body, 1
 Anorectal fistulæ, 221
 Anoscopes, 79
 Anterior rectopexy, rectorrhaphy and, rectocele repaired by, 397
 Anus, absence of, 45
 — treatment of, 55
 — actinomycosis of, 340
 — atresia of, anomalies resulting from, 45
 — congenital, 357
 — megacolon caused by, 425
 — treatment of, 55
 — chancre of, 350
 — chancroid infection of, 347
 — congenital atresia of, etiology of, 357
 — congenital syphilis of, 355
 — constitutional and infectious diseases causing ulceration of, 325
 — development of, 33
 — developmental defects of, 38
 — diabetic ulceration of, 325
 — epithelioma of, carcinoma differentiated from, 513
 — pathology of, 500
 — radiotherapy of, 531
 — fissure of, complications of, 199
 — diagnosis of, 199
 Anus, fissure of, dyschesia caused by, 121
 — etiology of, 196
 — incision for cure of, 205
 — location of, 196
 — megacolon caused by, 425
 — pathology of, 197
 — quinin and urea hydrochlorid in, 202
 — surgical treatment of, 204
 — symptoms of, 198
 — treatment of, 200
 — *See also* Fissure, anal.
 — fistula of, 221. *See also* Fistulæ, anal.
 — follicular ulceration of, 322
 — granuloma inguinale involving, 349
 — hemorrhoidal ulceration of, 324
 — hepatic ulceration of, 326
 — impalement of, 622
 — imperforate, anomalies due to, 48
 — diagnosis of, 40
 — mortality from different operations for, 54
 — operative treatment of, 57
 — prognosis of, 50
 — treatment of, 51
 — lacerations and contusions of, 619
 — lupoid ulceration of, 330
 — marasmic ulceration of, 326
 — membranous occlusion of, 47
 — mixed infection of, 351
 — mucosa of, 16
 — nephritic ulceration of, 325
 — occlusion of, treatment of, 55
 — painful or irritable ulcers of, 196
 — papillæ of, anatomy and physiology of, 16
 — papillomata of, diagnosis of, 476
 — pathogenesis of, 475
 — symptoms of, 476
 — treatment of, 476
 — patulous, surgical treatment of rectal incontinence in presence of, 618
 — phagedenic ulceration of, 348
 — stercoral ulceration of, 322
 — strictural ulceration of, 322
 — syphilis of, 350
 — congenital, 355
 — total absence of, 45
 — treatment of, 55
 — traumatic ulcerations of, 320
 — trophic ulceration of, 326
 — tuberculosis of, 328
 — typhoid ulceration of, 327
 — ulcerations of, classification of, 319
 — valves of, anatomy and physiology of, 16
 — varicose ulceration of, 323
 — venereal diseases of, 345
 — verrucous tuberculosis of, 331
 — wounds of, symptoms of, 624.
 — *See also* Anal canal.
 Appendages, caudal, 487, 488
 Appendicitis, chronic, mucomembranous colitis and, 273
 — enterovesical fistula caused by, 250
 Appendicostomy, chronic ulcerative colitis and, 293
 Appendix, arterial blood supply of, 293
 — sarcoma of incidence of, 591

- Aponeurosis, Denonvillier's, 5
 — presacral, 5
 — prostatoperitoneal, 5
 Archocele, 386
 Arteries, distal colon, 29
 — hemorrhoidal, 17
 — mesenteric, 29
 Arteriosclerosis, varicose ulceration caused by, 323
 Arthritis, chronic ulcerative colitis and, 281
 Astringent ointments, internal hemorrhoids and, 153
 Atonic constipation, 118
 Atresia, anal, anomalies resulting from, 45
 — congenital, 357
 — treatment of, 55
 — anorectal, megacolon caused by, 425
 Atresia ani vaginalis, operative treatment of, 57
 Atrophic coloproctitis, chronic, 267
 Atrophic proctocolitis, chronic, 267
 Auerbach's plexus, 24
 Autogenous vaccines, bacillary dysentery and, 302
 — chronic ulcerative colitis and, 292
- Bacillary dysentery, 300. *See also* Dysentery, bacillary.
Bacillus coli, pruritus ani caused by, 177
Bacillus diphtheriæ, coloproctitis caused by, 300
Bacillus dysenteriæ, coloproctitis caused by, 300
Bacillus tuberculosis, coloproctitis caused by, 300
Balantidium coli, 311
 Bands, intestinal, chronic mucous colitis and, 273
 — clinical significance of, 124, 136
 Bargen's diplococcus, chronic ulcerative colitis and, 277, 291
 Benzidin test, 99
 Bezoars, rectal and sigmoid, 629
Bilharzia hæmatobia, multiple adenomata and, 459
 Biopsy, intestinal tumors and, 90
 Bladder, carcinoma of, enterovesical fistula caused by, 250
 — imperforate rectum with outlet through, 43, 54
 Bleeding. *See* Hemorrhage.
 Blind fistulæ, 221
 Blood cultures, chronic ulcerative colitis and, 277
 Blood in stool, significance of, 100
 Blumer's "rectal shelf," 515
 Bone, disease of, fistulæ originating in, 245
 Bone-flap operation, complications of, 584
 — extirpation of rectum by, 543, 546
 Bougies, examination by, 94
 — rectal injury by, 620
 — rupture of sigmoid by, 623
 Bowel action, history of, 67
 Bowels, care of, malignant tumors and, 521
- Calculi, rectal and sigmoid, 628
 — vesical, prolapse of rectum and, 378, 382
 Cancer, definition of, 494
 — *See also* Carcinomata.
 Caput medusæ, significance of, 73
 Carbohydrate fermentation, stool signs of, 98
 Carbon dioxide snow, palliative treatment of stricture with, 367
 Carcinomata, chronic ulcerative colitis and, 280, 288
 — epidermoid, 500
 — general considerations of, 490
 — implantation of, 515
 — intestinal obstruction caused by, 442
 — Mikulicz two-stage resection of sigmoid for, 579
 — one-stage resection of sigmoid for, 576
 — perineal proctectomy for, 547
 — rectal and sigmoid, abdominoperineal excision of, 563
 — age incidence of, 496
 — causes of operative mortality in, 582
 — choice of anesthesia for, 545
 — choice of operation for, 545
 — colostomy in, 544
 — complete posterior excision with colostomy for, 559
 — contra-indications to radical excision of, 541
 — diagnosis of, 510
 — differential diagnosis of, 513
 — electrosurgery in treatment of, 533
 — excision of, 574
 — facts and opinions regarding, 538
 — function following operation for, 589
 — historical considerations of surgical treatment of, 542
 — metastasis of, 503
 — modes of spread of, 502
 — mortality following extirpation of, 585
 — multiple primary, 505
 — occurrence of, 496
 — operability of, 540
 — operative and postoperative complications of, 583
 — palliative surgery for, 523
 — palliative treatment of, 520
 — pathology of, 498
 — perineal proctectomy for, 547
 — Percy cautery in treatment of, 537
 — position of tumor, 498, 508
 — posterior fecal fistula following Kraske's operation for, 590
 — posterior resection for, 556
 — postoperative recurrence of, 588
 — preparation of patient for operation in, 544
 — procidentia recti following proctectomy for, 590
 — prognosis of, 516
 — radiotherapy of, 525
 — recurrence following radium treatment of, 531
 — secondary effects of irradiation in treatment of, 528
 — sex incidence of, 497

- Carcinomata, rectal and sigmoid, surgical treatment of, 540
 — — — symptoms of, 506, 508
 — — — treatment of, 520
 — — — tumor reaction to radium in treatment of, 528
 — sigmoid, diverticulosis differentiated from, 419
 — — — *See also* Carcinomata, rectal and sigmoid.
 — tube resection of sigmoid for, 576
 — vesical, enterovesical fistulæ caused by, 250
 — *See also* Malignant tumors.
 Casts, mucous, 274
 — pseudomembranous, chronic mucous colitis and, 270, 273
 Catarrhal proctitis, acute, 260
 Caudal anesthesia, 103, 107
 Caudal appendages, 487, 488
 Caudal block, 103, 107
 — operative indications for, 112
 — reactions following, 112
 — technic of, 110
 Cauterization, linear, partial prolapse of rectum and, 380
 — tuberculous fistula and, 244
 Cecostomy, chronic ulcerative colitis and, 292
 — indications for, 607
 — technic of, 607
 — valvular, chronic ulcerative colitis and, 203
 — Witzel's, technic of, 608
 Cecum, sarcoma of, incidence of, 591
 Cecum mobile, stasis toxemia and, 124
 Celiotomy, mortality of, 64
 Cerebrum, tumor of, chronic mucous colitis and, 273
 Chancre, anal, incidence of, 350
 — — — symptoms of, 351
 — — — treatment of, 351
 — anal fissure differentiated from, 199
 Chancroid, complications of, 348
 — incidence of, 347
 — phagedenic ulceration and, 348
 — treatment of, 348
 Charcoal test, 94
 Chemic stones, rectal and sigmoid, 628
Chilomastrix mesnili, 311
 Chlorosis, chronic mucous colitis and, 270
 Chordomata, sacrococcygeal, 485
 Chronic amebic dysentery, 306
 Chronic atrophic coloproctitis, 267
 Chronic atrophic proctocolitis, 267
 Chronic coloproctitis, 264
 Chronic constipation. *See* Constipation, chronic.
 Chronic intestinal obstruction, 444
 Chronic mucous colitis, 270
 Chronic proctocolitis, 264
 Chronic ulcerative colitis, 276
Ciliophora, classification of, 311
 Cirrhosis, hepatic, hemorrhage and, 73
 Cloaca, development of, 35
 Cloacal membrane, 35
 Coccygeal gland, 7
 Coccygeal sinus, 478
 Coccygodynia, anatomical considerations of, 189
 — diagnosis of, 190
 — etiology of, 189
 — prognosis of, 191
 — surgical treatment of, 193
 — symptoms of, 190
 — treatment of, 191
 Coccyx, excision of, 193
 Coffey's method of abdominoperineal excision, 570
 Colectomy, chronic ulcerative colitis and, 281, 296
 Coley's fluid, malignant tumors and, 522
 Colitis, acute, acute catarrhal proctitis and, 262
 — chronic mucous, diagnosis of, 274
 — — etiology of, 270
 — — pathology of, 273
 — — symptoms of, 274
 — — treatment of, 274
 — chronic non-specific ulcerative, amebic dysentery and, 316
 — chronic ulcerative, age incidence of, 276
 — — course of, 285
 — — diagnosis of, 285
 — — etiology of, 276
 — — incidence of, 276
 — — pathology of, 279
 — — prognosis, 287
 — — results of medical *vs.* surgical treatment in, 299
 — — surgical treatment of, 292
 — — symptoms of, 283
 — — treatment of, 289
 — — vaccine therapy in, 291
 — — *See also* Ulceration, follicular.
 — idiopathic ulcerative, 276
 — mucomembranous, 271
 — non-specific ulcerative, 276
 Colitis polyposa cystica, 460
 Colitis suppurativa, 276
 Colitis ulcerosa, 276
 Colloid metals, malignant tumors and, 522
 Colon, adhesions and kinks of, 124
 — distal, anatomy of, 25
 — — blood supply of, 29
 — — developmental defects, 38
 — — divisions of, 25
 — — lymphatics of, 31
 — — muscular coat of, 28
 — — nerve supply of, 31
 — — physiology of, 25, 31
 — — secretion and absorption in, 32
 — — serosa of, 27
 — — structure of, 27
 — — *See also* Sigmoid.
 — idiopathic dilatation of, 424
 — membranes of clinical significance in connection with, 124
 — pelvic, follicular ulceration of, 322
 — — ulcerations of, 319
 — — *See also* Sigmoid.
 — sarcoma of, incidence of, 591
 Colopexy, coloplication and, megacolon and, 432

- Coloplication, colopexy and, megacolon and, 432
- Coloproctitis, chronic, etiology of, 265
 - types of, 264
 - chronic atrophic, 267
 - chronic hypertrophic, chronic mucous colitis and, 271
 - classification of, 260
 - diagnosis of, 268
 - hemorrhagic, symptoms, 268
 - treatment of, 269
 - hypertrophic, 265
 - mucomembranous, 270
 - specific infections causing, 300
- Colostomy, abdominal, mortality of, 600
 - types of, 599
 - carcinoma of rectum and, 544
 - closure of, 609
 - complete posterior excision with, 559
 - control after, 606
 - extraperitoneal, 598
 - extraperitoneal closure of, 609
 - history of, 598
 - hyperplastic tuberculosis and, 339
 - imperforate rectum and, 53
 - inguinal, mortality of, 64
 - technic of, 604
 - intraperitoneal closure of, 610
 - irradiation of annular growths following, 531
 - lumbar, indications for, 599, 601
 - megacolon and, 432
 - palliative treatment of carcinoma with, 523, 531
 - perianal tuberculous ulcers and, 332
 - permanent, technic of, 604
 - Tuttle's, 605
 - postoperative treatment of, 612
 - rectal stricture and, 371
 - rectovaginal fistula and, 252
 - rectovesical and enterovesical fistula and, 251
 - rectus, technic of, 602
 - temporary, technic of, 602
 - tertiary anorectal syphilis and, 355
 - transverse permanent, technic of, 605
- Complete fistula, 221
- Complete posterior excision, colostomy and, technic of, 559
- Compressed air, injury of rectum and sigmoid by, 623
- Condyloma acuminatum, diagnosis of, 476
 - pathogenesis of, 475
 - symptoms of, 476
 - treatment of, 476
- Condylomata lata, 352
- Congenital anal atresia, 357
- Congenital stricture, 356
- Congenital syphilis, 355
- Congestion, portal, ulcerations caused by, 326
 - varicose ulceration caused by, 323
- Constipation, atonic, chronic, 118
 - chronic, chronic mucous colitis and, 275
 - chronic ulcerative colitis and, 278
 - complications of, 123
 - diagnosis of, 127
- Constipation, chronic, etiology and forms of, 117
 - fistula caused by, 221
 - functional motor disturbances causing, 118
 - internal hemorrhoids and, 150
 - intestinal obstruction and, 443
 - mechanical factors in, 118
 - megacolon and, 428
 - perianal abscess and, 208
 - prolapse of rectum caused by, 378
 - stasis toxemia and, 123
 - surgical treatment of, 135
 - symptoms of, 122
 - treatment of, 129
 - varicose ulceration caused by, 323
 - chronic spastic, 119
 - treatment of, 134
- Contusions, anal and rectal, 619
- Corrugator cutis ani, 8
- Cough, chronic, prolapse of rectum and, 382
- Critical point, rectosigmoidal anastomosis and, 30
- Cryptitis, definition of, 257
 - dyschesia caused by, 121
- Crypts of Morgagni, anatomy and physiology of, 16
- Curettage, palliative treatment of carcinoma with, 524
- Cutaneous abscess, 211
- Cutting current, electrosurgery and, 535
- Cystitis, hemorrhoidectomy and, 174
- Cystocele, rectocele complicated by, recurrence of, 401
- Cysts, dermoid, sacrococcygeal, 483
 - mesosigmoid, volvulus caused by, 437
 - sacrococcygeal, incidence of, 481
- Defecation, center of, 24, 32
 - physiology of, 31
- Denonvillier's aponeurosis, 5
- Dermoid cysts, sacrococcygeal, 483
- Descending colon, anatomy and physiology of, 25
- Developmental defects, etiology of, 39
 - incidence of, 38
- Diabetes mellitus, perianal abscess and, 208
 - pruritus ani caused by, 177
 - ulcerations caused by, 325
- Diagnostic methods, history, 65
- Diaphragm, pelvic, anatomy of, 14
- Diarrhea, prolapse of rectum caused by, 378
 - significance of, 67
 - summer, marasmic ulceration and, 326
- Diathermy, internal hemorrhoids and, 170
 - palliative treatment of, stricture by, 368
 - sigmoid stricture and, 377
 - surgical, 533
- Diet, acute catarrhal proctitis and, 261
 - amebic dysentery and, 311
 - bacillary dysentery and, 302
 - chronic constipation and, 130, 134
 - chronic mucous colitis and, 275
 - chronic ulcerative colitis and, 278, 289
 - hypertrophic proctocolitis and, 266

- Diet, malignant tumors and, 520
 — megacolon and, 431
 — pruritus ani and, 180
 — rectal prolapse and, 378
 — stasis toxemia and, 130
 Digital examination, 76
 Dilatation, idiopathic colonic, 424
 — sphincter, palliative treatment of strictures by, 366
 — prolapse of rectum caused by, 382
 — sigmoid stricture and, 377
 Dimples, sacrococcygeal, diagnosis of, 480
 — etiology of, 478
 — treatment of, 480
 Distal colon, anatomy of, 25
 — blood supply of, 29
 — developmental defects of, 38
 — divisions of, 25
 — lymphatics of, 31
 — muscular coat of, 28
 — nerve supply of, 31
 — physiology of, 25, 31
 — secretion and absorption in, 32
 — serosa of, 27
 — structure of, 27
 — *See also* Sigmoid.
 Diverticula, true and false, 413
 Diverticulitis, carcinoma differentiated from, 514
 — diagnosis of, 418
 — etiology of, 413
 — intestinal obstruction caused by, 442
 — pathology of, 415
 — prognosis of, 419
 — stricture of sigmoid and, 373
 — surgical treatment of, 421
 — symptoms of, 417
 — treatment of, 419
 — vesicosigmoidal fistula caused by, 250
 Diverticulosis, diagnosis of, 418
 — diverticulitis and, 413
 — etiology of, 414
 — prognosis of, 419
 — stricture of sigmoid and, 373
 — surgical treatment of, 421
 — symptoms of, 417
 — treatment of, 419
 Divulsion, sphincter, anal fissure and, 204
 Douglas' culdesac, anatomy of, 4
 — hernia of, prolapse of rectum and, 382
 — obliteration of, repair of complete rectal prolapse through abdomen by, 405
 Drugs, acute catarrhal proctitis caused by, 261
 — chronic constipation and, 131
 — chronic ulcerative colitis and, 280
 — hypertrophic proctocolitis and, 266
 — malignant tumors and, 521
 Dyschesia, etiology of, 120, 125
 — mechanical factors in, 121
 — prolapse of rectum caused by, 382
 — sigmoidorectal prolapse and, 387
 Dysentery, acute amebic, symptoms of, 306
 — amebic, chronic ulcerative colitis and, 276
 — complications of, 307
 — diagnosis of, 307
 Dysentery, amebic, etiology of, 303
 — incidence of, 303
 — occurrence of, 302
 — pathology of, 305
 — prognosis of, 311
 — stricture following, 358
 — symptoms of, 306
 — treatment of, 311
 — bacillary, amebic dysentery differentiated from, 309
 — chronic ulcerative colitis and, 276
 — pathology of, 301
 — treatment of, 302
 — types of, 300
 — chronic amebic, symptoms of, 306
 Dyspepsia, nervous, 274
 Earle's operation, internal hemorrhoids and, 167
 Eczema, perianal ulceration caused by, 319
 Edema, perianal hemorrhoidectomy complicated by, 154, 172
 Elastic ligature, fistula treated with, 230
 Electricity, chronic constipation and, 133
 Electrocoagulation, internal hemorrhoids and, 170
 — malignant tumors and, 534
 Electrodesiccation, internal hemorrhoids and, 169
 — malignant tumors and, 534
 Electrolysis, pruritus ani and, 183
 Electrosurgery, malignant tumors treated by, 533
 Electrothermy, palliative treatment of stricture by, 368
 Embryology, 33
 Emetin, amebic dysentery and, 312
 Emetin bismuthous iodid, amebic dysentery and, 314
 Endocrine glands, chronic mucous colitis and dysfunction of, 270, 273
 Endotheliomata, sacrococcygeal, 485
 Endothermy, 533
 Enemata, chronic constipation and, 132
Entamoeba coli, 303
Entamoeba histolytica, culture of, 309
 — discovery of, 302
 — morphology of, 308, 310
Entamoeba tetragena, 303
 Entero-anastomosis, megacolon and, 433
 — palliative treatment of carcinoma by, 524
 Enterocoele, anterior rectopexy and rectorrhaphy for, 403
 — incidence of, 402
 — prolapse of rectum and, 384
 Enteroliths, intestinal obstruction caused by, 442
 — rectal and sigmoid, 628
 Enteroptosis, chronic mucous colitis and, 273
 — general, Glenard's disease or, 136
 Enterostasis, chronic, major surgical measures for, 137
 Enterovesical fistula, 248
 Epidermoid carcinomata, pathology of, 500
 Epidural, block, 103

- Epitheliomata, anal, carcinoma differentiated from, 513
 — radiotherapy of, 531
 — anal fissure differentiated from, 200
 Ether anesthesia, relative value of, 103
 Ethylene anesthesia, relative value of, 102
 Eversion method of abdominoperineal excision, 570
 Examination, bacteriological, 98
 — bougies and rectal tubes in, 94
 — charcoal test in, 94
 — digital, 76
 — general, 73
 — general anesthesia and, 95
 — instrumental, 80
 — laboratory, 96
 — local, inspection and palpation in, 74
 — pathologic discharges and, 99
 — positions for, 70
 — preparation of patient for, 67
 — roentgenologic, 93
 — stool, 97
 — urine, 96
 — vaginal, 78
 — x-ray, 93
 Excision, Kraske's sacral, mortality of, 585
 — posterior, Kraske's, 556
 — rectal, colostomy and complete posterior, 559
 — sacral, Kraske's, 543
 — vaginal, proctectomy by, 543
 — *See also* Ablation; Proctectomy.
 Exercise, chronic constipation and, 129
 — stasis toxemia and, 129
 External genitalia, development of, 36
 External hemorrhoids. *See* Hemorrhoids, external.
 External proctotomy, 370
 Extradural block, 103
 Extraperitoneal closure of colostomy opening, 609
 Extraperitoneal colostomy, 598

 Fascia lunata, 13
 Fecal fistula, posterior, excision of sigmoid carcinoma and, 590
 Fecal impaction, diagnosis of, 138
 — symptoms of, 138
 — treatment of, 139
 Fecal incontinence, fistula operations complicated by, 255
 — hemorrhoidectomy complicated by, 173
 — treatment of fistula and, 240, 241
 — *See also* Incontinence, rectal.
 Fecaliths, intestinal obstruction caused by, 442
 Fecaloma, etiology of, 628
 — megacolon and, 428
 Fermentation, carbohydrate, stool signs of, 98
 — salol in, 264
 Fibroma, rectal, characteristics of, 472
 Fibrosarcoma, rectal, pathology of, 593
 Finsen light, perianal tuberculous ulcers and, 332
 Fissures, anal, complications of, 199
 — diagnosis of, 109
 — dyschesia caused by, 121
 — etiology of, 196
 — fistula following, 221
 — hemorrhoidectomy complicated by, 172
 — incision for cure of, 205
 — location of, 196
 — megacolon and, 425
 — pathology of, 197
 — quinin and urea hydrochlorid in, 202
 — surgical treatment of, 204
 — symptoms of, 198
 — treatment of, 200
 — under treatment of, 206
 — perineal, mercurochrome and, 268
 Fistulae, abscesses complicating, treatment of, 239
 — anal, fissure causing, 198
 — "blind," 221
 — diagnosis of, 226, 227
 — treatment of, 242
 — bone disease giving rise to, 245
 — classification of, 221
 — complicated, 245
 — complications in operations for, 254
 — diagnosis of, 224
 — injections in, 225
 — Salmon's law in, 226
 — division of sphincter in incision of, 240
 — enterovesical, 248
 — etiology of, 221
 — excision and immediate suture of, 233
 — fecal, excision of sigmoid carcinoma and, 590
 — genital, 246, 252
 — high internal openings of, treatment of, 242
 — horseshoe, 227
 — treatment of, 242
 — incision and excision of, 235
 — incontinence of feces complicating operations for, 255
 — lateral openings of, treatment of, 241
 — multiple internal openings of, treatment of, 241
 — operative treatment of, 232
 — complications in, 254
 — pathology of, 221
 — perineal, 246
 — posterior fecal, excision of sigmoid carcinoma and, 590
 — posterior horseshoe, 222
 — prognosis of, 228
 — rectal, actinomycosis and, 341
 — recto-ureteral, 246
 — recto-urethral, 246
 — excision of sigmoid carcinoma complicated by, 583
 — recto-uterine, 246, 254
 — rectovaginal, 246
 — chronic ulcerative colitis and, 280
 — treatment of, 252
 — rectovesical, 246, 248
 — excision of sigmoid carcinoma complicated by, 583

- Fistulæ, rectovulval, 246
 — treatment of, 254
 — sigmoidovesical, 246
 — subcutaneous, 222
 — symptoms of, 224
 — treatment of, 228
 — operative, 232
 — tuberculous, diagnosis of, 228
 — pathology of, 223
 — prognosis of, 228
 — treatment of, 244
 — urinary, 246
 — vesicosigmoidal, diverticulitis and, 250, 422
 — "watering pot," 224
 Flexner's bacillus, 300
 Fluoroscopy, 93
 — stasis toxemia and, 128
 Focal infection, chronic ulcerative colitis and, 277, 292
 Follicular coloproctitis, 265
 Follicular ulceration, 322
 Foreign bodies, rectal and sigmoid, classification of, 628
 — complications of, 636
 — diagnosis of, 637
 — prognosis of, 637
 — symptoms of, 635
 — treatment of, 638
 Foreign protein therapy, chronic ulcerative colitis and, 292
 Fossæ, intersigmoid, 26
 — ischiorectal, relation of anal canal to, 13
 — retrorectal abscess and, 6
 — pararectal, 4
 Fulguration, perianal tuberculous ulcers and, 332

 Gall-bladder, disease of, chronic mucous colitis and, 272
 Gall-stones, intestinal obstruction caused by, 442
 — rectal and sigmoid invasion by, 629
 Galvanopuncture, internal hemorrhoids and, 169
 Ganglionectomy, lumbar sympathetic, ramisection and, 435
 Gangrene, intestinal, excision of sigmoid carcinoma complicated by, 584
 Gastro-enteroptosis, chronic mucous colitis and, 273
 General anesthesia, 102
 — examination under, 95
 General enteroptosis. *See* Glenard's disease.
 General examination, 73
 Genital fistula. *See* Fistulæ, genital.
 Genitalia, external, development of, 36
Giardia lamblia, 300, 311
 Glands, coccygeal, 17
 — Lieberkühn's, 9
 — Luschka's, 17
 Glenard's disease, stasis toxemia and, 136
 Gliomata, sacrococcygeal, 485
 Gonorrhea, diagnosis of, 346
 — etiology of, 345
 — stricture of rectum caused by, 359

 Gonorrhea, symptoms of, 346
 — treatment of, 346
 Granuloma inguinale, 349
 Gumma, anorectal, 353
 Gunshot wounds, 621

 Headache, chronic mucous colitis and, 274
 Heart, disease of, varicose ulceration caused by, 323
 Heliotherapy, tuberculous ulcerations and, 331, 337
 Hemangioblastomata. *See* Nevi.
 Hemorrhage, chronic ulcerative colitis and, 280
 — excision of sigmoid carcinoma complicated by, 584
 — fistula operations complicated by, 254
 — hemorrhoidectomy complicated by, 171
 — history of, 66
 — internal hemorrhoids and, 148
 — rectal, significance of, 100
 Hemorrhagic coloproctitis, 268
 Hemorrhoidal ulceration, 324
 Hemorrhoids, classification of, 141
 — definition of, 141
 — electricity in treatment of, 168
 — external, thrombotic, 141
 — internal, clamp and cautery operation for, 162
 — complications following operation for, 170
 — degenerative changes in, 148
 — diagnosis of, 151
 — diathermy in treatment of, 170
 — dyschesia caused by, 121
 — Earle's operation for, 167
 — electricity in treatment of, 168
 — electrocoagulation in treatment of, 170
 — electrodesiccation in treatment of, 169
 — etiology of, 146
 — excision and immediate suture of, 166
 — exciting causes of, 147
 — galvanopuncture in, 169
 — general and palliative treatment of, 152
 — high-frequency treatment of, 169
 — injection treatment of, 155
 — ionization in, 169
 — ligature operation for, 160
 — occurrence of, 145
 — operative treatment of, 158
 — pathology of, 148
 — perianal abscess and, 208
 — postoperative recurrence of, 173
 — postoperative treatment of, 173
 — predisposing causes of, 146
 — prolapsed and strangulated, palliative treatment of, 153, 255
 — symptoms and signs of, 148
 — treatment of, 152
 — Whitehead's operation for, 166, 172, 614
 — prolapse of, fistula operations complicated by, 255
 — rectal incontinence caused by, 614
 — thrombosed internal, carcinoma differentiated from, 513

- Hepatic ulceration, 326
- Hepatoduodenocolic membrane, clinical significance of, 124
- Heredity, internal hemorrhoids and, 146
- malignant neoplasms and, 493
- Hernia, congenital posterior vaginal, 5
- peritoneal, prolapse of rectum and, 382
- posterior vaginal, prolapse of rectum and, 384, 385
- — rectopexy and rectorrhaphy for, 399, 402
- rectal, 386
- Herpetic ulceration of anus, 318
- Herter's diplococcus, chronic ulcerative colitis and, 277
- High-frequency current, internal hemorrhoids and, 169
- Hilton's white line, 17
- Hirschsprung's disease, age incidence of, 424
- diagnosis of, 430
- etiology of, 424, 425
- familial tendency of, 426
- intestinal obstruction caused by, 442
- occurrence of, 424
- pathology of, 426
- prognosis of, 430
- symptoms of, 428
- treatment of, 431
- types of, 426
- Hiss' bacillus, 301
- History taking, 65
- Horseshoe fistula, 222, 227
- treatment of, 242
- Houston's valves, anatomy and physiology of, 10
- Hydrotherapy, external, chronic constipation and, 133
- Hyperplastic tuberculosis, 337
- stricture of sigmoid and, 373
- Hypertrophic coloproctitis, 265
- Hypertrophic proctocolitis, 265
- Hypochondriasis, chronic mucous colitis and, 274
- Hysteria, coccygodynia and, 190
- rectal, 194
- Idiopathic dilatation of colon, 424
- Idiopathic ulcerative colitis, 276
- Ileosigmoidostomy, chronic ulcerative colitis and, 297
- Ileostomy, chronic ulcerative colitis and, 292, 296
- hemorrhagic coloproctitis and, 270
- Ileum, sarcoma of, incidence of, 591
- Iliac colon, anatomy and physiology of, 25
- *See also* Sigmoid.
- Impaction, fecal, diagnosis of, 138
- — symptoms of, 138
- — treatment of, 139
- Impalement, anal and rectal, 622
- Imperforate anus, diagnosis of, 40
- mortality from different operations for, 54
- operative treatment of, 57
- prognosis of, 50
- treatment of, 51
- Imperforate rectum, diagnosis of, 40
- incidence of, 39
- prognosis of, 50
- treatment of, 51
- Implantation tumors, 505, 515
- Incomplete fistula, 221
- Incontinence, fecal, fistula operations complicated by, 255
- — hemorrhoidectomy complicated by, 173
- — treatment of fistulae and, 240, 241
- rectal, diagnosis of, 615
- — etiology of, 613
- — treatment, 616
- Infection, acute catarrhal proctitis caused by, 260
- chancroid, complications of, 348
- — incidence, 347
- — phagedenic ulceration and, 348
- — treatment of, 348
- chronic mucous colitis and, 273
- chronic specific, rectal stricture caused by, 359
- chronic ulcerative colitis and, 276
- coloproctitis caused by, 300
- gonococcal, rectal stricture following, 359
- hemorrhoidectomy complicated by, 172
- perianal abscess and, 208
- pruritus ani caused by, 177
- Inflammation, malignancy and, 495
- Inflammatory stricture, 358
- Infralevator abscesses, 211
- Inguinal colostomy, mortality of, 64
- technic of, 604
- Injections, alcohol, coccygodynia and, 191
- diagnosis of fistulae by, 225
- internal hemorrhoids treated by, 155
- subcutaneous, pruritus ani and, 185
- Injuries. *See* Traumata.
- Instrumental examination, 80
- Internal hemorrhoids. *See* Hemorrhoids, internal.
- Internal proctotomy, procedure in, 369
- International Symposium on Cancer Control, resolution adopted by, 538
- Intersigmoid fossa, anatomy of, 26
- Intestinal diverticula, stricture of sigmoid and, 373
- Intestinal obstruction, diagnosis of, 443
- etiology of, 441
- prognosis of, 445
- symptoms of, 443
- treatment of, 445
- Intestinal protozoa, classification of, 309
- Intestines, sarcoma of, incidence of, 591
- Intraperitoneal closure of colostomy opening, 610
- Intussusception, intestinal obstruction caused by, 442
- acute catarrhal proctitis caused by, 261
- Ionization, hemorrhagic coloproctitis and, 270
- internal hemorrhoids and, 169
- pruritus ani and, 183
- Irradiation. *See* Roentgen ray.
- Irrigations, malignant tumors and, 521
- Ischiorectal abscess, 213

- Ischiorectal abscess, horseshoe fistula and, 14
 Ischiorectal fossæ, relation of anal canal to, 13
 — retrorectal abscess and, 6
- Jackson's membrane, clinical significance of, 124
- Kinks, intestinal, chronic mucous colitis and, 273
 — — stasis toxemia and, 124
- Kidney, movable, chronic mucous colitis and, 273
- Kraske's sacral or posterior excision, 543
 — carcinoma of rectum and, 556
 — mortality of, 585
 — posterior fecal fistula following, 590
- Laboratory examinations, 96
- Lacerations, anal and rectal, 619
- Lake Mohonk Symposium, resolution adopted by, 538
- Lane's kink, chronic mucous colitis and, 273
 — clinical significance of, 124
- Leiomyomata, rectal and sigmoid, incidence of, 468
 — — symptoms and treatment of, 469
- Leukemia, lymphatic, chronic ulcerative colitis and, 288
- Lieberkühn's glands, anatomy and physiology of, 9
- Ligature, elastic, treatment of fistula with, 230
- Linear cauterization, partial prolapse of rectum and, 380
- Linear proctotomy, procedure in, 370
- Lipomata, caudal appendages and, 488
 — rectal and sigmoid, diagnosis of, 467
 — — forms of, 465
 — — symptoms of, 466
 — — treatment of, 467
- Liver, abscess of, amebic dysentery complicated by, 307
 — — chronic ulcerative colitis and, 281
 — cirrhosis of, hemorrhage and, 73
 — congestion of, ulceration caused by, 326
- Local anesthesia, 103
- Local examination, digital, 76
 — inspection and palpation in, 74
- Lumbar colostomy, indications for, 599, 601
- Lumbar sympathetic ganglionectomy and ramisectomy, megacolon and, 435
- Lupoid ulceration, 330
- Lupus exedens, 330
- Luschka's gland, 7
- Lymphatic leukemia. *See* Leukemia, lymphatic.
- Lymphatics, anal canal, 21
 — distal colon, 31
 — rectal, 21
- Lymphosarcomata, chronic ulcerative colitis and, 288
 — rectal, pathology of, 593
- Malignancy, multiple adenomata of rectum and sigmoid transformed into, 462
 — sacrococcygeal tumors and, 485
- Malignant tumors, etiology of, 493
 — facts and opinions regarding, 538
 — general considerations of, 490
 — incidence of, 490
 — predisposing conditions to, 494
 — rectal and sigmoid, abdominoperineal excision of, 563
 — — causes of operative mortality in, 582
 — — complete posterior excision with colostomy for, 559
 — — excision of, 574
 — — function following operation for, 589
 — — Kraske's posterior resection for, 556
 — — Mikulicz two-stage resection for, 579
 — — mortality following extirpation of, 585
 — — operative and postoperative complications of, 583
 — — perineal proctectomy for, 547
 — — posterior fecal fistula following Kraske's operation for, 590
 — — posterior resection for, 556
 — — postoperative recurrence, 588
 — — procidentia recti following proctectomy for, 590
 — — surgical treatment of, 540
 — — treatment of, electrosurgery in, 533
 — — palliative, 520
 — — palliative surgical, 523
 — — Percy cautery in, 537
 — — radium in, 525
 — — recurrence following use of radium in, 531
 — — secondary effects of irradiation in, 528
 — — tumor reaction to radiation in, 528
 — *See also* Carcinoma; Sarcoma.
- Marasmic ulceration, 326
- Marasmus, rectal prolapse and, 378
- Marginal abscess, 211
- Massage, chronic constipation and, 133
- Mestigophora*, classification of, 309
- Maydl-Reclus inguinal colostomy, technic of, 604
- Megacolon, age incidence, 424
 — diagnosis of, 430
 — etiology of, 424, 425
 — familial tendency of, 426
 — intestinal obstruction caused by, 442
 — occurrence of, 424
 — pathology of, 426
 — prognosis of, 430
 — symptoms of, 428
 — treatment of, 431
 — types of, 426
- Meissner's plexus, 24
- Melanosarcomata, rectal, pathology of, 593
- Melena, hemorrhagic coloproctitis and, 268
- Membranes, chronic mucous colitis and, 273
- Meningitis, chronic mucous colitis and, 273
- Mesentery, sigmoid volvulus resulting from rotation of, 437
- Mesonephric ducts, development of cloaca and, 35
- Metastatic carcinomata, 503

- Methylene-blue, diagnosis of fistula by injection of, 225
- perianal tuberculous ulcers and, 331
 - rectal ulcerations and, 321
- Microsporon audouini*. See Ringworm.
- Migraine, chronic mucous colitis and, 274
- Mikulicz operation, complete rectal prolapse and, 408
- Milk, *Acidophilus*, chronic constipation and, 130, 134
- pruritus ani and, 180
 - injections of, chronic ulcerative colitis and, 291
- Molluscum fibrosum, fibroma of rectum and, 472
- Morgagni, crypts of, 16
- inflammation of, 257
- Mount Desert bacillus, 300
- Movable kidney, chronic mucous colitis and, 273
- Mucomembranous coloproctitis, 270
- Mucopus, significance of, 100
- Mucous casts, 274
- Mucous colitis, chronic. See Colitis, chronic mucous.
- Mucous patches, 352
- Müllerian ducts, development of cloaca and, 36
- Multiple adenomata, rectal and sigmoid, diagnosis of, 463
- etiology of, 459
 - malignant transformation of, 462
 - symptoms of, 461
- Multiple primary carcinomata, 506
- Mural abscess, 220
- Myelitis, trophic ulceration caused by, 326
- Myxorrhoea coli, 270
- Neoplasms, cerebral, chronic mucous colitis and, 273
- implantation, 505
 - intestinal, biopsy of, 90
 - intestinal obstruction caused by, 442
 - lumbar cord, trophic ulceration caused by, 326
 - malignant, abdominoperineal excision of rectum for, 563
 - causes of operative mortality, surgical treatment of, 582
 - complete posterior excision of rectum with colostomy for, 559
 - electrosurgery in treatment of, 533
 - etiology of, 493
 - excision of sigmoid for, 574
 - facts and opinions regarding, 538
 - function following operation for, 589
 - general considerations of, 490
 - incidence of, 490
 - Kraske's posterior resection of rectum for, 556
 - Mikulicz two-stage resection for, 579
 - mortality following extirpation of, 585
 - operative and postoperative complications of, 583
 - palliative surgery for, 523
- Neoplasms, malignant, Percy cautery in treatment of, 537
- perineal proctectomy for, 547
 - posterior fecal fistula following Kraske's operation for, 590
 - posterior resection of rectum for, 556
 - postoperative recurrence of, 588
 - predisposing conditions to, 494
 - procidentia recti following proctectomy for, 590
 - radiotherapy of, 525
 - recurrence following use of radium in treatment of, 531
 - secondary effects of irradiation in treatment of, 528
 - surgical treatment of, 540
 - treatment of, 520
 - tumor reaction to radium in treatment of, 528
 - See also Carcinomata; Sarcomata.
 - mesosigmoid, volvulus caused by, 437
 - pelvic, varicose ulceration caused by, 323
 - rectal, digital examination for, 77
 - non-malignant, 446
 - sacrococcygeal, diagnosis of, 486
 - incidence of, 481
 - symptoms of, 485
 - treatment of, 487
 - sigmoid, non-malignant, 446
- Nephritic ulceration, 325
- Nephritis, ulcerations caused by, 325
- Nerves, anal canal, 23
- distal colon, 31
 - rectal, 23
- Nervi erigentes, rectal relations of, 5
- Nervous dyspepsia, 274
- Nervus pelvici, mucous colitis and overstimulation of, 272
- Neuralgia, chronic mucous colitis and, 274
- rectal, 194
- Neurasthenia, chronic mucous colitis and, 274
- coccygodynia and, 190
- Neurosis, rectal, 194
- secretory, chronic mucous colitis and, 270
- Nevi, perianal, treatment of, 474
- Nitrous oxid-oxygen anesthesia, relative value of, 103
- Non-haustation, chronic ulcerative colitis and, 280
- Non-malignant tumors, 446
- Non-specific ulcerative colitis, 276
- Obliteration of Douglas' pouch, 405
- Obstipation. See Constipation, chronic.
- Obstruction, intestinal, diagnosis of, 443
- etiology of, 441
 - prognosis of, 445
 - symptoms of, 443
 - treatment of, 445
- Occlusion, anal, treatment of, 55
- Occult blood, benzidin test for, 99
- Operations, abdominoperineal excision for carcinoma of rectum, 563
- ablation in partial prolapse of rectum, 380

- Operations, amputation of complete rectal prolapse, 408
- amputation of rectum with sacrifice of sphincters, 553
 - anterior rectoexy and rectorrhaphy for prolapse, 397
 - appendicostomy, 293
 - causes of mortality in, carcinomata of rectum and sigmoid and, 582
 - cecostomy, 607
 - choice of, carcinoma of rectum and, 545
 - closure of colostomy opening, 609
 - coccygodynia, 191, 193
 - Coffey's method of abdominoperineal excision, 570
 - coloplication and colopexy for megacolon, 432
 - colostomy, megacolon and, 432
 - — rectal stricture and, 371
 - combined operation or abdominoperineal excision, 563
 - complete posterior excision with colostomy, 559
 - curettage in palliative treatment of carcinoma, 524
 - diverticulosis, 421
 - electrical treatment of rectal stricture, 368
 - electrodesiccation and electrocoagulation, 534
 - entero-anastomosis for megacolon, 433
 - eversion method of abdominoperineal excision, 570
 - excision and resection of rectum, rectal stricture and, 370
 - excision of rectum with preservation of sphincters, 547
 - external proctotomy, rectal stricture and, 370
 - extraperitoneal closure of, 609
 - fissure, 200, 204
 - Hirschsprung's disease and, 431
 - ileostomy, 296
 - inguinal colostomy (Maydl-Reclus), 604
 - injection treatment of internal hemorrhoids, 158
 - internal hemorrhoids, 158
 - internal proctotomy for rectal stricture, 369
 - intraperitoneal closure of, 610
 - Kader-Gibson's valvular cecostomy, 608
 - Kraske's posterior resection, 556
 - linear cauterization in partial rectal prolapse, 380
 - linear or complete proctotomy, rectal stricture and, 370
 - lumbar sympathetic ganglionectomy and ramisectomy for megacolon, 435
 - Maydl-Reclus inguinal colostomy, 604
 - megacolon, 431
 - Mikulicz' procedure for complete rectal prolapse, 408
 - Mikulicz two-stage resection of sigmoid, 579
 - obliteration of Douglas' pouch through abdomen, 405, 407
- Operations, one-stage resection of sigmoid for cancer, 576
- perineal proctectomy, position of patient in, 547
 - perineal proctectomy, technic of, 547
 - permanent colostomy, 604
 - plastic narrowing of anal outlet for complete prolapse, 391
 - preparation of patient for, 100
 - — fistulæ and, 232
 - — internal hemorrhoids and, 158
 - — proctectomy and, 544
 - pruritus ani, 187
 - rectal incontinence, 617
 - rectoexy for complete prolapse, 391
 - rectorrhaphy and anterior rectoexy for prolapse, 397
 - rectus colostomy, 602
 - resection for megacolon, 433
 - sacral rectoexy, 392
 - sigmoidoexy for prolapse, 407
 - tamponade of retrorectal space for prolapse, 394
 - temporary colostomy, 602
 - transverse colostomy, 605
 - transverse plication for acute sigmoid volvulus, 440
 - tube resection for carcinoma of sigmoid, 574
 - Tuttle's permanent colostomy, 605
 - two-stage resection of sigmoid for cancer, 579
 - valvular cecostomy, 608
 - Witzel's cecostomy, 608
- Ovary, dermoids of, rectum invaded by, 484
- Oxyuris vermicularis*, acute catarrhal proctitis caused by, 261
- anal warts and, 475
 - pruritus ani caused by, 177
- Pain, history of, 66
- internal hemorrhoids and, 149
 - palliative treatment of, malignant tumors and, 521
 - referred, anal canal and, 25
- Papillæ, anal, anatomy and physiology of, 16
- dyschesia caused by hypertrophy of, 121
- Papillitis, 258
- Papillomata, anal, diagnosis of, 476
- — pathogenesis of, 475
 - — symptoms of, 476
 - — treatment of, 476
- carcinomata differentiated from, 514
- rectal and sigmoid, etiology of, 455
- — symptoms of, 457
 - — treatment of, 459
- Parasitic amebæ, 304
- Parturition, chronic ulcerative colitis and, 278
- fistula caused by injury during, 221
 - internal hemorrhoids complicating treatment of, 153
 - perineal rupture during, rectal incontinence caused by, 614
- Pectinate line, 16

- Pelvic colon, anatomy and physiology of, 25
- *See also* Sigmoid; Colon, pelvic.
- Pelviorectal abscess, 208
- superior, 216
- Pelviorectal space, 5
- Pelviorectal valve, 11
- Pelvis, diaphragm of, anatomy of, 14
- tumors of, varicose ulceration caused by, 323
- Percy cautery, malignant tumors treated by, 537
- Perforation, stercoral ulceration causing, 323
- Perianal abscess, 208
- Perianal edema, hemorrhoidectomy complicated by, 154, 172
- Perianal tuberculosis, ulcerative, 328
- Perianal ulceration, 318
- Pericolitis, stercoral ulceration causing, 323
- Peridiverticulitis, stricture of sigmoid and, 373
- Perineal cracks, treatment of, 268
- Perineal proctectomy, 547
- mortality of, 585
- Perineoplasty, mortality of, 64
- Perineum, laceration of, prolapse of rectum following, 382
- rupture of, rectal incontinence and, 614
- Perirectal abscess, 208
- Peristalsis, calcium chlorid and, 336
- Peritoneal bands, clinical significance of, 124, 136, 273
- Peritonitis, amebic dysentery and, 305
- chronic ulcerative colitis and, 280, 288, 292
- excision of sigmoid carcinoma complicated by, 584
- foreign bodies in rectum or sigmoid complicated by, 636
- impalement injuries causing, 622
- plastic tuberculous, carcinoma differentiated from, 515
- stercoral ulceration causing, 323
- Permanent colostomy, 559, 604
- Phagedenic ulceration, anal and rectal, 348
- Phantom stricture, 356
- Phimosis, rectal prolapse caused by, 378
- Phototherapy, perianal tuberculous ulcers and, 332
- Pilonidal cysts, 478, 480
- Pin-worms, pruritus ani caused by, 177
- Plastic narrowing of anal outlet, complete rectal prolapse and, 391
- Plastic tuberculous peritonitis, carcinoma differentiated from, 515
- Poliomyelitis, trophic ulceration caused by, 326
- Polypi, adenomatous, 448
- prolapse of rectum caused by, 382
- rectal, partial prolapse caused by, 378
- Polypoid sarcomata, rectal, diagnosis of, 595
- Polyposis, chronic ulcerative colitis and, 281, 288
- multiple, acute catarrhal proctitis and, 262
- Posterior excision, complete, colostomy and, 559
- Posterior fecal fistula, excision of sigmoid carcinoma and, 590
- Posterior resection, Kraske's, carcinoma of rectum and, 556
- Precancerous conditions, 494
- Pregnancy, chronic ulcerative colitis and, 278
- internal hemorrhoids complicating, treatment of, 153
- Preparation of patient for operation, 100
- fistulae and, 232
- internal hemorrhoids and, 158
- proctectomy and, 544
- Prerectal abscess, 6
- Prerectal space, 5
- Presacral aponeurosis, 5
- Procidencia recti, excision of sigmoid carcinoma followed by, 590
- Proctectomy, abdominoperineal combined operation of, mortality of, 585
- methods of, 543
- mortality of, 585
- perineal, technic of, 547
- position of patient for, 547
- Proctitis, acute catarrhal, diagnosis of, 263
- etiology of, 260
- pathology of, 262
- symptoms of, 262
- treatment of, 263
- chronic, mucomembranous colitis and, 273
- classification of, 260
- rectal neuralgia and, 194
- Proctocolitis, chronic, etiology, 265
- types of, 264
- chronic atrophic, treatment of, 267
- classification of, 260
- hemorrhagic, 268
- hypertrophic, 265
- Proctoplasty, imperforate rectum and, 52
- mortality of, 64
- technic of, 52
- Proctoscopy, technic of, 85
- Proctosigmoidoscopy, dangers of, 89
- Proctotomy, internal, procedure in, 369
- linear or complete, procedure in, 370
- Prolapse, complete rectal, amputation of, 408
- anterior rectopexy and rectorrhaphy for, 397
- comment on surgical treatment of, 411
- complications of, 387
- degrees of, 381
- etiology of, 381
- Mikulicz, operation for, 408
- obliteration of Douglas' pouch for, 405, 407
- operations through abdomen for, 405
- operative treatment of, 390
- pathology of, 382
- plastic narrowing of anal outlet for, 391
- sigmoidopexy for, 407, 409
- symptoms of, 386
- tamponade of retrorectal space for, 394
- treatment of, 389
- hemorrhoid and mucosa, fistula operations complicated by, 255
- partial rectal, etiology of, 378
- pathology of, 378
- symptoms of, 379
- treatment of, 380

- Prolapse, rectal, acute catarrhal proctitis caused by, 261
 — — excision of sigmoid carcinoma followed by, 590
 — — marasmic ulceration and, 326
 — — rectal incontinence caused by, 614
 — — reduction of, 389
 — — sigmoidorectal, 387
 Prostate, disease of, rectovesical fistula caused by, 248
 — hypertrophy of, carcinoma differentiated from, 515
 — — prolapse of rectum and, 382
 — — rectal neuralgia and, 194
 — massage of, ulceration of rectum caused by, 321
 Prostatoperitoneal aponeurosis, 5
 Protein putrefaction, stool signs of, 98
 Protein sensitization, chronic mucous colitis and, 273
 Protein therapy, chronic ulcerative colitis and, 292
 Protozoa, coloproctitis caused by, 300
 — intestinal, classification of, 309
 Protrusion, history of, 66
 — internal hemorrhoids and, 149
 Pruritus ani, diagnosis of, 179
 — etiology of, 176
 — internal hemorrhoids and, 150
 — occurrence of, 176
 — pathology and distribution of, 178
 — prognosis of, 180
 — subcutaneous injections in technic of, 185
 — submucous fistulae causing, 257
 — surgical treatment of, 186
 — symptoms of, 179
 — treatment of, 180
 Pruritus scroti, 176
 Pruritus vulvæ, 176
 Pseudomembranous casts, chronic mucous colitis and, 270, 273
 Punctured wounds, anal and rectal, 620
 Purgatives, vegetable, chronic constipation and, 131
 — saline, chronic constipation and, 131
 Pus, significance of, 100
 Putrefaction, protein, stool signs of, 98

 Quartz lamp, perianal tuberculous ulcers and, 331
 — tuberculous fistula and, 244
 — tuberculous ulcerations and, 337

 Radiotherapy. *See* Roentgen rays.
 Radium, actinomycosis and, 344
 — carcinoma treated with, 525
 — rectal mucosa susceptible to, 321
 — *See also* Roentgen rays.
 Radon, enterovesical fistula caused by, 250
 — *See also* Roentgen rays.
 Ramisectomy, lumbar sympathetic, ganglionectomy and, megacolon and, 435
 Recklinghausen's disease, fibroma of rectum and, 472

 Rectal enemas, chronic constipation and, 132
 Rectal fistula, 221
 Rectal incontinence, diagnosis of, 615
 — etiology of, 613
 — treatment of, 616
 Rectal shelf, Blumer's, 77, 515
 Rectal tubes, examination by, 94
 Rectal valves, anatomy and physiology of, 10
 Rectitis, acute, acute catarrhal proctitis and, 262
 Rectocele, prolapse of rectum and, 384
 — anterior rectopexy and rectorrhaphy for, 399
 Rectocolitis gravis, 276
 Rectopexy, anterior, rectorrhaphy and, 397
 — sacral, complete prolapse and, 392
 Rectorrhaphy, anterior rectopexy and, complete prolapse repaired by, 397
 Rectosigmoidal anastomosis, importance of, 29
 Rectosigmoidal prolapse, diagnosis of, 389
 — etiology of, 387
 — reduction of, 389
 — symptoms of, 388
 Recto-urethral fistula, excision of sigmoid carcinoma complicated by, 483
 Recto-uterine fistula, 254
 Rectovaginal fistula. *See* Fistulae, recto-vaginal.
 Rectovaginal pouch, 4
 Rectovesical fistula, 248
 — excision of sigmoid carcinoma complicated by, 583
 Rectovesical pouch, 4
 Rectovesical septum, 5
 Rectovulval fistula, 254
 Rectum, accidental introduction of foreign bodies into, 633
 — actinomycosis of, diagnosis of, 342
 — — incidence of, 340
 — — pathology of, 341
 — — prognosis of, 343
 — — symptoms of, 342
 — — treatment of, 343
 — adenocarcinoma of, pathology of, 500
 — adenomata of, diagnosis of, 449 463
 — — incidence of, 446
 — — symptoms of, 449, 461
 — — treatment of, 450, 463
 — adenomyoma of, diagnosis of, 471
 — — occurrence of, 469
 — — symptoms of, 471
 — amputation, perineal operation for, 547
 — anatomy of, 1
 — angioma of, treatment of, 473
 — arteries of, 17
 — atresia of megacolon caused by, 425
 — bezoars in, 629
 — calculi in, 628
 — capacity of, 2
 — carcinoma of, abdominoperineal excision of, 563
 — — age incidence of, 496
 — — anesthesia for, 545
 — — causes of operative mortality in, 582
 — — choice of operation for, 545
 — — colostomy in, 544

- Rectum, carcinoma, complete posterior excision with colostomy for, 559
- contra-indications to radical excision of, 541
 - diagnosis of, 510
 - differential diagnosis of, 513
 - electrosurgery in treatment of, 533
 - facts and opinions regarding, 538
 - function following operation for, 589
 - historical considerations of surgical treatment of, 542
 - metastasis of, 503
 - methods of sacral resection in extirpation of rectum in, 542
 - modes of spread of, 502
 - mortality following extirpation of, 585
 - multiple primary, 505
 - occurrence of, 496
 - operability of, 540
 - operative and postoperative complications of, 583
 - palliative surgery for, 523
 - palliative treatment of, 520
 - pathology of, 498
 - Percy cautery in treatment of, 537
 - perineal proctectomy for, 547
 - position of tumor, 498, 508
 - posterior fecal fistula following Kraske's operation for, 590
 - posterior resection for, 556
 - postoperative recurrence of, 588
 - preparation of patient for operation in, 544
 - procidentia recti following proctectomy for, 590
 - prognosis of, 516
 - radiotherapy of, 525
 - recurrence following use of radium in treatment of, 531
 - secondary effects of irradiation in treatment of, 528
 - sex incidence of, 497
 - surgical treatment of, 540
 - symptoms of, 506, 508
 - treatment of, 520
 - tumor reaction to radium in treatment of, 528
 - chancre of, 350
 - chancroid infection of, 347, 348
 - chemical injury of, 619
 - complete prolapse of, amputation of, 408
 - anterior rectopexy and rectorrhaphy for, 397
 - complications of, 387
 - comment on surgical treatment of, 411
 - degrees of, 381
 - etiology of, 381
 - Mikulicz operation for, 408
 - obliteration of Douglas' pouch for, 405, 407
 - operations through abdomen for, 405
 - operative treatment of, 390
 - pathology of, 382
 - plastic narrowing of anal outlet for, 391
 - sigmoidopexy for, 407, 409
 - symptoms of, 386
- Rectum, complete prolapse of, tamponade of retrorectal space for, 394
- treatment of, 389
 - congenital syphilis of, 355
 - congenital stricture of, megacolon caused by, 426
 - constitutional and infectious diseases causing ulceration of, 325
 - dermoids of, 483
 - development of, 33
 - developmental defects of, 38
 - diabetic ulceration of, 325
 - enteroliths in, 628
 - excision of, stricture and, 370
 - *See also* Ablation; Amputation; Proctectomy.
 - fetal remains in, 629
 - fibroma of, characteristics of, 472
 - fixation of, 2
 - follicular ulceration of, 322
 - foreign bodies in classification of, 628
 - complications of, 636
 - diagnosis of, 637
 - prognosis of, 637
 - symptoms of, 635
 - treatment of, 638
 - gall-stones in, 629
 - gunshot wounds of, 621
 - hemorrhage from, significance of, 100
 - hemorrhoidal ulceration of, 324
 - hepatic ulceration of, 326
 - hyperplastic tuberculosis of, incidence of, 337
 - pathology of, 338
 - symptoms of, 338
 - treatment of, 339
 - impalement of, 622
 - imperforate, incidence of, 39
 - diagnosis of, 40
 - prognosis of, 50
 - treatment of, 51
 - implantation tumors of, 505
 - lacerations and contusions of, 619
 - lateral ligaments or stalks of, 5
 - leiomyoma of, incidence of, 468
 - symptoms and treatment of, 469
 - lipoma of, diagnosis of, 467
 - forms of, 465
 - symptoms of, 466
 - treatment of, 467
 - lymphatics of, 21
 - malignant tumors of, etiology of, 493
 - general consideration of, 490
 - incidence of, 490
 - predisposing conditions to, 494
 - *See also* Rectum, carcinoma of.
 - marasmic ulceration of, 326
 - methods of sacral resection in extirpation of, 542
 - miliary tuberculosis of, 334
 - mucosa of, 9
 - radium producing ulceration of, 321
 - multiple adenomata of, diagnosis of, 463
 - etiology of, 459
 - malignant transformation of, 462
 - symptoms of, 461

- Rectum, multiple adenomata of, treatment of, 463
- muscular coat of, 8
 - neoplasms of, digital examination for, 77
 - non-malignant, 446
 - See also* Malignant tumors.
 - nephritic ulceration of, 325
 - nerve supply of, 23
 - neuralgia and hysteria of, 194
 - non-malignant tumors of, 446
 - papilloma of, etiology of, 455
 - symptoms of, 457
 - treatment of, 459
 - partial prolapse of, etiology of, 378
 - pathology of, 378
 - symptoms of, 379
 - treatment of, 380
 - peritoneal relations of, 4
 - phagedenic ulceration of, 348
 - physiology of, 1
 - pneumatic wounds of, 623
 - prolapse of, acute catarrhal proctitis caused by, 261
 - excision of sigmoid carcinoma followed by, 590
 - marasmic ulceration and, 326
 - reduction of, 389
 - sigmoidorectal, 387
 - relations of, 6
 - resection of, stricture and, 370
 - See also* Rectum, excision of.
 - rupture of, 622
 - treatment of, 627
 - sarcoma of, course of, 594
 - diagnosis of, 595
 - incidence of, 591
 - pathology of, 591
 - prognosis of, 595
 - symptoms of, 594
 - treatment of, 596
 - types of, 591, 593
 - sheath of, 5
 - spaces before and behind, 5
 - stercoral ulceration of, 322
 - strictural ulceration of, 32
 - stricture of, chronic ulcerative colitis and, 280
 - diagnosis of, 364
 - digital examination for, 77
 - etiology of, 356
 - forms of, 356
 - intestinal obstruction and, 442
 - pathology of, 362
 - prognosis of, 365
 - rectal incontinence caused by, 614
 - recurrence after operation for, 373
 - symptoms of, 363
 - treatment of, 365, 369
 - structure of, 7
 - submucous coat of, 9
 - surgical instruments recovered from, 629
 - swallowed foreign bodies in, 630
 - syphilis of, 350
 - syphilitic ulceration of, 352
 - traumatic ulcerations of, 320
 - trophic ulceration of, 326
- Rectum, tuberculous ulceration of, diagnosis of, 336
- etiology of, 332
 - symptoms of, 334
 - treatment of, 336
 - types of, 332
 - typhoid ulceration of, 327
 - ulcerations of, classification of, 319
 - urinary calculi in, 629
 - urogenital outlet in, 45
 - treatment of, 55
 - valves of, 10
 - varicose ulceration of, 323
 - vascular supply of, 17
 - veins of, 18
 - venereal diseases of, 345
 - wounds of, 619
 - symptoms of, 624
- Rectus colostomy, technic of, 602
- Referred pain, 66
- Reflex disturbances, internal hemorrhoids and, 151
- Reflex pain, anal fissure and, 198
- Regional anesthesia, 103
- Resection, Kraske's posterior, 556
- Kraske's sacral, posterior fecal fistula following, 590
 - megacolon and, 443
 - sacral, methods of, 542
 - tube, carcinoma of sigmoid and, 574
- Rest, chronic ulcerative colitis and, 289
- Retention, urinary, excision of sigmoid carcinoma complicated by, 584
- fistula operations complicated by, 254
 - hemorrhoidectomy complicated by, 170
- Retrorectal abscess, 218
- Retrorectal space, 5
- tamponade of, complete rectal prolapse and, 394
- Rhizopodia*, classification of, 309
- Ringworm, perianal ulceration caused by, 318
- Rodent ulcer, perianal, 319
- Roentgen rays, anal epithelioma treated by, 531
- annular growths following colostomy treated by, 531
 - carcinoma treated with, 525
 - diagnosis of carcinoma by, 512
 - diverticulosis diagnosed by, 418
 - intestinal obstruction and, 444
 - megacolon diagnosed by, 430
 - perianal tuberculous ulcers and, 332
 - pruritus ani and, 183
 - tuberculous fistula treated by, 244
- Roentgenologic examination, 93
- Rupture, rectal, 622
- treatment of, 627
 - sigmoid, 623
- Sacral anesthesia, 103
- technic of, 104
 - See also* Anesthesia, sacral.
- Sacral block, 103
- Sacral excision, Kraske's, 543
- mortality of, 585

- Sacral rectopexy, technic of, 392
 Sacral resection, Kraske's, posterior fecal fistula following, 590
 — methods of, 542
 Sacrococcygeal cavity, 7
 Sacrococcygeal dimples, sinuses, cysts and tumors, 478, 481
 Salmon's law, diagnosis of fistula and, 226
 Sarcomata, rectal, course of, 594
 — diagnosis of, 595
 — incidence of, 591
 — pathology of, 591
 — prognosis of, 595
 — symptoms of, 594
 — treatment of, 596
 — types of, 591, 593
 — sacrococcygeal, 485
 Schaudinn's *Amaba dysenteriae*, 304
 Seat-worms, pruritus ani caused by, 177
 Secretory neurosis, chronic mucous colitis and, 270
 Sentinel pile, Brodie's, 198
 Sepsis, excision of sigmoid carcinoma complicated by, 584
 — hemorrhoidectomy complicated by, 172
 Sera, antidyenteric, 302
 Sheath, rectal, 5
 Shiga's bacillus, 300
 Shock, anaphylactic, chronic mucous colitis and, 273
 — anesthesia and, 545
 — excision of sigmoid carcinoma complicated by, 584
 Short-circuiting. *See* Entero-anastomosis.
 Sigmoid, accidental introduction of foreign bodies into, 633
 — actinomycosis of, 340
 — adenocarcinoma of, pathology of, 500
 — adenoma of, diagnosis of, 449, 463
 — incidence of, 446
 — symptoms of, 449, 461
 — treatment of, 450, 463
 — bezoars in, 629
 — calculi in, 628
 — carcinoma of, age incidence of, 496
 — causes of operative mortality in, 582
 — contra-indications to radical excision of, 541
 — diagnosis of, 510
 — differential diagnosis of, 513
 — electrosurgery in treatment of, 533
 — excision of, 574
 — facts and opinions regarding, 538
 — function following operation for, 589
 — historical considerations of surgical treatment of, 542
 — metastasis of, 503
 — Mikulicz two-stage resection for, 579
 — modes of spread of, 502
 — mortality following extirpation of, 585
 — multiple primary, 505
 — occurrence of, 496
 — one-stage resection for, 576
 — operability of, 540
 — operative and postoperative complications of, 583
 Sigmoid, carcinoma of, palliative surgery for, 523
 — palliative treatment of, 520
 — pathology of, 498
 — Percy cautery in treatment of, 537
 — position of tumor, 498, 508
 — posterior fecal fistula following Kraske's operation for, 590
 — postoperative recurrence of, 588
 — procidentia recti following proctectomy for, 590
 — prognosis of, 516
 — radiotherapy of, 525
 — recurrence following use of radium in treatment of, 531
 — secondary effects of irradiation in treatment of, 528
 — sex incidence of, 497
 — surgical treatment of, 540
 — symptoms of, 506, 508
 — treatment of, 520
 — tube resection for, 574
 — tumor reaction to radium in treatment of, 528
 — constitutional and infectious diseases causing ulceration of, 325
 — diabetic ulceration of, 325
 — diverticulitis of, vesicosigmoidal fistula caused by, 250
 — enteroliths in, 628
 — follicular ulceration of, 322
 — foreign bodies in, classification of, 628
 — complications of, 636
 — diagnosis of, 637
 — prognosis of, 637
 — symptoms of, 635
 — treatment of, 638, 639
 — gall-stones in, 629
 — hemorrhoidal ulceration of, 324
 — hepatic ulceration of, 326
 — hyperplastic tuberculosis of, incidence of, 337
 — pathology of, 338
 — symptoms of, 338
 — treatment of, 339
 — leiomyoma of, incidence of, 468
 — symptoms and treatment of, 469
 — lipoma of, diagnosis of, 467
 — forms of, 465
 — symptoms of, 466
 — treatment of, 467
 — malignancy of, diverticulosis differentiated from, 418
 — malignant tumors of, etiology of, 493
 — general considerations of, 490
 — incidence of, 490
 — predisposing conditions to, 494
 — *See also* Sigmoid, carcinoma of.
 — marasmic ulceration of, 326
 — multiple adenomata of, diagnosis of, 463
 — etiology of, 459
 — malignant transformation of, 462
 — symptoms of, 461
 — treatment of, 463
 — nephritic ulceration of, 325
 — non-malignant tumors of, 446

- Sigmoid, papilloma of, etiology of, 455
 — symptoms of, 457
 — treatment of, 459
 — pneumatic wounds of, 623
 — rupture of, 623
 — stercoral ulceration of, 322
 — strictural ulceration of, 322
 — stricture of, diagnosis of, 364, 374
 — etiology of, 356, 373
 — forms of, 356
 — pathology of, 362
 — prognosis of, 365
 — recurrence after operation for, 373
 — symptoms of, 363, 373
 — treatment of, 365, 369
 — swallowed foreign bodies in, 630
 — traumatic ulcerations of, 321
 — trophic ulceration of, 326
 — tuberculous ulceration of, diagnosis of, 336
 — symptoms of, 334
 — treatment of, 336
 — tuberculosis of, etiology of, 332
 — types of, 332
 — typhoid ulceration of, 327
 — ulceration of, classification of, 319
 — urinary calculi in, 629
 — varicose ulceration of, 323
 — volvulus of, diagnosis, 438
 — etiology of, 437
 — incidence of, 437
 — obstruction caused by, 442
 — pathogenesis of, 437
 — prognosis of, 438
 — surgical treatment of acute, 440
 — symptoms of, 438
 — treatment of, 438
 — wounds of, 619
 — See also Colon, distal.
- Sigmoiditis, acute, acute catarrhal proctitis and, 262
 — rectal neuralgia and, 194
- Sigmoidorectal prolapse, diagnosis of, 389
 — etiology of, 387
 — reduction of, 389
 — symptoms of, 388
- Sigmoidoscopy, 84
- Sims' position, 71
- Sinuses, sacrococcygeal, diagnosis of, 480
 — etiology of, 478
 — treatment of, 480
- Skin tags, hemorrhoidectomy complicated by, 172
- Spaces, retrorectal, pelvirectal and prerectal, 5
- Spasmodic strictures, 356
- Spasmyxorrhoea, nervous, 271
- Spastic constipation, 119
 — treatment of, 134
- Specula, rectal, 80
- Sphincter ani internus, anatomy of, 8
- Sphincter ani externus, anatomy and physiology of, 15
 — nerve supply of, 24
 — rectal continence depending on integrity of, 613
- Sphincter algia, dyschesia caused by, 121
- Sphincters, amputation of rectum with sacri-fice of, 553
 — division of, incision of fistula and, 240
 — divulsion of, anal fissure and, 204
 — excision of rectum with preservation of, 547
 — prolapse of rectum caused by division of, 382
- Spina bifida, imperforate rectum and, 45
- Spinal anesthesia, contra-indications for, 116
 — indications for, 115
 — materials for, 113
 — mortality from, 116
 — postoperative care in, 115
 — rectal carcinoma and, 545
 — technic of, 114
- Spirochæta pallida*, coloproctitis caused by, 300
- Sporozoa*, classification of, 311
- Staphylococcus aureus*, pruritus ani caused by, 177
- Stasis toxemia, clinical types of, 127
 — definition of, 123
 — diagnosis of, 127
 — pathology of, 126
 — surgical treatment of, 135
 — treatment of, 129
- Static electricity, chronic constipation and, 134
- Stenosis, congenital anal canal, treatment of, 55
- Stercoral ulceration, 322
- Stones, chemic, rectal and sigmoid, 628
 — See also Calculi.
- Stools, *Entamæba histolytica* in, 308
 — examination of, 97
 — ribbon-shaped, significance of, 67
- Streptococci, pruritus ani caused by, 177
- Streptococcus erysipelatis*, coloproctitis caused by, 300
- Streptococcus faecalis*, pruritus ani and, 177, 183
- Strictural ulceration, 322
- Strictures, congenital, diagnosis of, 364
 — etiology of, 356
 — megacolon caused by, 426
 — pathology of, 362
 — prognosis of, 365
 — recurrence after operation for, 373
 — treatment of, 365, 369
 — etiology of, 356
 — forms of, 356
 — hemorrhoidectomy complicated by, 172
 — inflammatory, carcinoma differentiated from, 513
 — chronic specific infections causing, 359
 — diagnosis of, 364
 — etiology of, 358
 — pathology of, 362
 — prognosis of, 365
 — recurrence after operation for, 373
 — treatment of, 365, 369
 — phantom, 356
 — rectal, 322
 — chronic ulcerative colitis and, 280
 — digital examination for, 77

- Strictures, rectal, intestinal obstruction
 caused by, 442
 — rectal incontinence caused by, 614
 — rectal and pelvic colon, electrical treatment
 of, 368
 — carbon dioxide snow in treatment of,
 367
 — diagnosis, 364
 — dilatation in treatment of, 366
 — etiology of, 356
 — palliative treatment of, 366
 — pathology of, 362
 — preventive treatment of, 365
 — prognosis of, 365
 — recurrence after operation for, 373
 — surgical treatment of, 369
 — symptoms of, 363
 — treatment of, 365
 — sigmoid, 322
 — diagnosis of, 374
 — etiology of, 373
 — symptoms of, 373
 — treatment of, 377
 — spasmodic, 356
 — traumatic, diagnosis of, 364
 — etiology of, 357
 — pathology of, 362
 — prognosis of, 365
 — recurrence after operation for, 373
 — treatment of, 365, 369
 — urethral, prolapse of rectum and, 382
 Submucous abscess, 220
 Summer diarrhea, 326
 Superior pelvirectal abscess, 216
 Supralevator abscesses, 216
 Surgical diathermy, 533
 — internal hemorrhoids and, 170
 Syphilis, chancre the primary lesion of,
 350
 — congenital, 355
 — marasmic ulceration and, 326
 — secondary manifestations of, 352
 — stricture of rectum caused by, 361
 — tertiary lesions of, 353
 — treatment of, 355
 Syphilitic ulceration, 352
 Syphiloma, anorectal, 355
- Tabes dorsalis, prolapse of rectum and, 382
 — trophic ulceration caused by, 326
 Tachycardia, chronic mucous colitis and, 274
 Tænia, rectal prolapse caused by, 378
 Tamponade, chronic constipation and, 133
 — retrorectal, complete rectal prolapse and,
 394
 Temporary colostomy, 599, 601
 Teratomata, sacrococcygeal, 484
 Thread-worms, pruritus ani caused by, 177
 Thrombosed internal hemorrhoids, carcinoma
 differentiated from, 513
 Thrombotic external hemorrhoids, diagnosis
 of, 142
 — treatment of, 144
 Tobacco, chronic mucous colitis and, 273
 Tonics, postoperative, 175
- Toxemia, stasis, clinical types of, 127
 — definition of, 123
 — diagnosis of, 127
 — pathology of, 126
 — surgical treatment of, 135
 — treatment of, 129
 Transsacral block, 103, 109
 — operative indications for, 112
 — reactions following, 112
 — technic of, 110
 Transverse colostomy, technic of, 605
 Traumata, acute catarrhal proctitis caused
 by, 261
 — anal, 619
 — symptoms of, 624
 — treatment of, 625
 — gunshot, anal and rectal, 621
 — malignant neoplasms and, 494
 — perianal abscess and, 208
 — pneumatic, rectal and sigmoid, 623
 — rectal, 619
 — symptoms of, 624
 — treatment of, 625
 — sigmoid, 619
 — symptoms of, 624
 — treatment of, 625
 — volvulus following, 437
 Traumatic stricture, 357
 Traumatic ulcerations, 320
Trichomonas intestinalis, 311
 Trichophyton. See Ringworm.
Tricocephalus dispar, pruritus ani caused by,
 177
 Trophic ulceration, 326
 Tropical liver abscess, 307
 Tuberculosis, bovine and human, relative fre-
 quency of infection by, 333
 — hyperplastic, carcinoma differentiated from,
 514
 — incidence of, 337
 — intestinal obstruction caused by, 442
 — pathology of, 338
 — stricture caused by, 360
 — stricture of sigmoid and, 373
 — symptoms of, 338
 — treatment of, 339
 — marasmic ulceration and, 326
 — perianal, abscess and, 208
 — treatment of, 331
 — types of, 328
 — rectal, etiology of, 332
 — types of, 332
 — sigmoid, etiology of, 332
 — types of, 332
 — stricture of rectum caused by, 359
 — ulcerative perianal, 328
 — ulcerative rectal, 334
 — verrucous, 331
 Tuberculous cutis ani, 328
 Tuberculous peritonitis, plastic, carcinoma
 differentiated from, 515
 Tuberculous fistula. See Fistulæ, tuberculous.
 Tube resection, carcinoma of sigmoid and, 574
 Tumors. See Neoplasms.
 Tuttle's permanent colostomy, technic of, 605
 Typhoid ulceration, 327

- Ulcerations, amebic dysentery and, 305
 —anal, classification of, 319
 ——diagnosis of, 327
 ——etiology of, 196
 ——location of, 196
 ——symptoms of, 327
 —chancroidal, treatment of, 348
 —constitutional and infectious diseases causing, 325
 —diabetic, 325
 —dysenteric, stricture following, 358
 —follicular, 322
 —gastroduodenal, chronic mucous colitis and, 272
 —hemorrhoidal, varicose ulceration and, 323, 324
 —hepatic, 326
 —lupoid, 330
 —marasmic, 326
 —nephritic, 325
 —perianal, eczematous, 319
 ——etiology of, 318
 ——herpetic, 318
 ——ringworm causing, 318
 ——rodent, 319
 —phagedenic, chancroid and, 348
 —rectal, classification of, 319
 ——diagnosis of, 327
 ——symptoms of, 327
 —rodent, 219
 —sigmoid, classification of, 319
 ——diagnosis of, 327
 ——symptoms of, 327
 —stercoral, 322
 —strictural, 322
 —syphilitic, 352
 —traumatic, 320
 —trophic, 326
 —tuberculous, 328, 332
 ——sigmoid stricture caused by, 373
 —typhoid, 327
 —varicose, 323
 Ulcerative colitis, chronic. *See* Colitis, chronic ulcerative.
 Ulcerative perianal tuberculosis, 328
 Ulcerative rectal tuberculosis, 334
 Ultraviolet rays, pruritus ani and, 184
 —tuberculous ulcerations and, 337
 Urethra, imperforate rectum with outlet through, 43, 54
 —stricture of, prolapse of rectum and, 382
 Urethritis, perineal abscess and, 208
 Urinary fistulæ. *See* Fistulæ, urinary.
 Urine, examination of, 96
 —retention of, excision of sigmoid carcinoma complicated by, 584
 ——fistula operations complicated by, 254
 ——hemorrhoidectomy complicated by, 584
 Urobilin, significance of, 99
 Uterus, imperforate rectum with outlet through, 54

 Vaccines, actinomyces, actinomycosis and, 344
 —bacillary dysentery and, 302

 Vaccines, chronic ulcerative colitis and, 291
 —pruritus ani and, 184
 Vagina, imperforate rectum with outlet through, 41, 54
 Vaginal examination, 78
 Vaginal excision, extirpation of rectum by, 543
 Vaginal hernia, posterior, prolapse of rectum and, 384, 385
 ——rectopexy and rectorrhaphy for, 399, 402
 Vagus, mucous colitis and overstimulation of, 272
 Valves, anal, anatomy and physiology of, 16
 ——cryptitis and, 257
 ——rectal, anatomy and physiology of, 10
 Valvular cecostomy, chronic ulcerative colitis and, 293
 —Kader-Gibson's, 608
 Varicose ulceration, 323
 Veins, anal canal, 18
 —distal colon, 31
 —hemorrhoidal, 18
 —rectal, 18
 Venereal diseases, anal and rectal, 345
 Venereal warts, 352
 —diagnosis of, 476
 —pathogenesis of, 475
 —symptoms of, 476
 —treatment of, 476
 Vermiform appendix, arterial blood supply of, 293
 —inflammation of, enterovesical fistula caused by, 250
 ——mucomembranous colitis and, 273
 —sarcoma of, incidence of, 591
 Verruca acuminata, 352
 —diagnosis of, 476
 —pathogenesis of, 475
 —symptoms of, 476
 —treatment of, 476
 Vesical calculi, prolapse of rectum and, 382
 —rectal prolapse caused by, 378
 Vesicosigmoidal fistulæ, diverticulitis and, 422
 Vibration, chronic constipation and, 133
 Volvulus, chronic, megacolon caused by, 426
 —sigmoid, diagnosis of, 438
 ——etiology of, 437
 ——incidence of, 437
 ——obstruction caused by, 442
 ——pathogenesis of, 437
 ——prognosis of, 438
 ——surgical treatment of acute, 440
 ——symptoms of, 438
 ——treatment by, 438

 Warts, anal, diagnosis of, 476
 ——pathogenesis of, 475
 ——symptoms of, 476
 ——treatment of, 476
 —venereal, 352
 Whitehead operation, rectal incontinence following, 614
 —internal hemorrhoids and, 166
 ——stricture following, 172

- | | |
|---|---|
| White line, Hilton's, 17 | X-ray. <i>See</i> Roentgen rays. |
| Whooping-cough, rectal prolapse caused by, 378, 382 | X-ray examination, 93 |
| Witzel's cecostomy, 608 | |
| Wolffian ducts, development of cloaca and, 35 | Yatren, amebic dysentery and, 314 |
| Worms, intestinal, pruritus ani caused by, 177 | Zander machines, chronic constipation and, 133 |
| — — rectal prolapse caused by, 378 | Zinc cataphoresis, perianal tuberculous ulcers and, 332 |
| Wounds. <i>See</i> Traumatata. | |

COUNTWAY LIBRARY



HC 2QXS W

t. 3800

Proctology : a treatise on the 1929

Countway Library

BFJ0637



3 2044 046 273 462

t. 3800
Proctology : a treatise on the 1929
Countway Library BFJ0637



3 2044 046 273 462